



DEPARTAMENTO DE CIÊNCIAS DA VIDA

FACULDADE DE CIÊNCIAS E TECNOLOGIA
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Payments for Environmental Services as a
policy tool for conserving the Portuguese
Montado ecosystem

Thaís de Toledo Ribas

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Dissertação apresentada à Universidade de
Coimbra para cumprimento dos requisitos
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dos Santos (Universidade Nova de Lisboa) e
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(Universidade de Coimbra)

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Abstract

Natural systems provide a multitude of goods and services that benefit human societies, known as environmental services (ES). Most of these ES are currently undervalued, or have no economic value at all, and ecosystem managers have no direct incentives to ensure their provision. The market failure in incorporating the value of natural systems is a major reason behind current ecosystem losses and unsustainable use of resources.

The *Montado* ecosystem in Portugal is an agro-silvo-pastoral system of high conservation value because it sustains high biodiversity and provides important ES. Its ecological stability is depended on traditional management practices, which have become economically unviable due to recent changes in the context for Portuguese agriculture. *Montados* are current threatened by land use change, and innovative policy tools are needed to maintain the economic viability of these systems. “Payments for Ecosystem Services” (PES) is an incentive-based mechanism considered a new promising policy tool to address environmental problems. It relies on arrangements through which ES beneficiaries pay individuals or communities to undertake practices that increase levels of desired services. PES is a highly variable instrument whose success is determined by choices in policy design combined with implementation context. The aim of this project is to propose PES as a conservation tool for *Montados*.

This project started with literature review of the *Montado* ecosystem and the instrument PES. Then, *Montado*’s potential to provide the three major groups of ES sold to date was assessed, as well as the current demand for them. It was concluded that PES schemes should focus on the services *biodiversity protection* and *carbon sequestration and storage*, for which demand may come from voluntary buyers or government-funded payments. This

insight was complemented with lessons learned from the analysis of three case studies. The mechanisms and case studies selected for *biodiversity protection* were: Environmental Certification (The Biodiversity and Wine Initiative, South Africa); and Payments for Environmental Stewardship (The Environmental Stewardship Scheme, United Kingdom). For *carbon sequestration and storage*, The Scolel Te Project (Mexico) was chosen to represent small-scale project targeting voluntary markets.

As final outcome, this work analyses potential of the three mechanisms to *Montados*. It also highlights the main caveats and challenges of implementing these tools, in order to provide guidance and advice to policymakers and project developers. In general, the main requirements for applying PES are: reliable sources of funding; the presence of a strong intermediary; and understanding the science behind ES provision.

From this study was concluded that PES is a policy tool with several advantages but its implementation can be complex and costly. The mechanisms analysed are only suitable to very specific situations, where requirements are met and challenges can be overcome. Thus, none of them should be considered a universal solution. Instead, *Montados* conservation is more likely to be attained through the implementation of several different instruments, each one applied to specific situations where they have greater chances to achieve desired results.

Resumo

Os ecossistemas naturais são responsáveis por provisionar uma série de bens e serviços que condicionam o bem-estar humano, os quais são conhecidos como serviços ambientais (ES). A maioria deles possui valor econômico nulo ou muito baixo, o que faz com que os gestores dos ecossistemas não tenham incentivo para garantir sua provisão. A falta de reconhecimento do valor dos ES no mercado é uma das principais razões por trás da destruição do meio ambiente e do uso insustentável dos recursos naturais.

O ecossistema do Montado, em Portugal, é um sistema agro-silvo-pastoral que apresenta alta biodiversidade e fornece importantes ES. Sua estabilidade ecológica depende de práticas de manejo tradicionais, as quais se tornaram economicamente inviáveis após mudanças no contexto agrícola português. Os Montados encontram-se ameaçados e necessitam de políticas inovadoras para manter sua viabilidade econômica. “Pagamentos por Serviços Ambientais” (PES) é um instrumento baseado em incentivos econômicos considerado uma nova e promissora abordagem para problemas ambientais. Este instrumento consiste em acordos onde beneficiários de serviços ambientais pagam indivíduos ou comunidades pela adoção de práticas que aumentem os níveis dos serviços desejados. PES são altamente variáveis, e seu sucesso é determinado por escolhas feitas durante a sua concepção, bem como por particularidades no contexto de implementação. Este trabalho tem como objetivo propor PES como uma ferramenta de conservação ambiental para os Montados.

Este trabalho se inicia com uma revisão literária sobre os Montados e sobre o instrumento a ser proposto. Em seguida, é analisado o potencial do ecossistema-alvo em provisionar os três principais grupos de serviços comercializados atualmente, bem como a demanda por

estes serviços. Conclui-se análise que PES em Montados devem focar-se nos serviços *proteção da biodiversidade* e *armazenamento e sequestro de carbono*. Demanda para estes serviços deve vir de compradores voluntários e pagamentos financiados pelo governo. Tais descobertas são completadas com lições retiradas da análise de três estudos de caso escolhidos para representar esquemas de PES compatíveis com características do Montado e com suas limitações de mercado. Os mecanismos e estudos de caso selecionados para *proteção da biodiversidade* foram: Certificação ambiental (The Biodiversity and Wine Initiative, África do Sul); e Pagamentos por Manejo Sustentável (The Environmental Stewardship Scheme, Inglaterra). Para *armazenamento e sequestro de carbono*, o Projeto Scolel Te (México) foi selecionado para representar projetos em pequena escala visando mercados voluntários.

Como resultado final, este trabalho analisa a adequabilidade de cada um dos mecanismos para o ecossistema do Montado. No intuito de fornecer orientação para políticos e conservacionistas, são apontados os maiores desafios da implementação destas ferramentas. Os requisitos mais relevantes para a aplicação de PES são: uma fonte de financiamento; um intermediário forte; e compreensão da ciência por trás da provisão de ES.

Como conclusão, PES é uma ferramenta com muitas vantagens, porém sua implementação pode ser complexa e custosa. Os mecanismos analisados são apenas aplicáveis a situações muito específicas onde requisitos mínimos são cumpridos e desafios superados. Por isso, nenhum deles deve ser considerado uma solução universal. A conservação dos Montados tem maiores chances de ser alcançada através da implementação de diversos instrumentos concomitantemente, cada um deles aplicado nas situações onde o potencial de alcançar os resultados desejados é maior.

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Acronyms

AES	Agri-environmental Schemes
BWI	Biodiversity and Wine Initiative
CFR	Cape Floral Region
ELS	Entry Level Stewardship
ES	Environmental Services
ESS	Environment Stewardship scheme
EU ETS	European Union Emissions Trading Scheme
EU	European Union
GHG	Green House Gas
HLS	Higher Level Stewardship
IPCC	Intergovernmental Panel on Climate Change
IPW	Integrated Production of Wine Scheme
LULUCF	Land Use Change and Forestry
NGO	Non-Governmental Organization
PES	Payments for Environmental Services
PRODER	Portuguese Rural Development Program
RDPE	Rural Development Programme for England
RMU	Removal Units
UK	United Kingdom
VER	Verified Emission Reductions
WOSA	Wines of South Africa
WS	Watershed Services

Chapter 1

Introduction

In our daily life we benefit from a multitude of goods and services provided by natural systems. We are constantly depending on environmental components that support life, such as food, clean air and water, as well as on natural processes that are less-obvious but crucial to sustain life on earth, such as climate regulation and nutrient cycling (MA, 2005). “Ecosystem Services” is the term used to refer to all the benefits we obtain from nature. According to The Millennium Ecosystem Assessment, (MA, 2005) they are divided into four categories: provisioning services, which are products obtained from ecosystems (*e.g.* food, water, fuel); regulating services, which are benefits resulting from regulation of natural processes (*e.g.* air quality and climate regulation); cultural services, which are non-material benefits obtained from ecosystems (*e.g.* recreation, spiritual enjoyment); and supporting services, which form the foundation for all other ecosystem services (*e.g.* soil formation, nutrient and water cycling).

Commonly, trade-offs may arise among the different services provided within an ecosystem. Management practices aiming to increase the output of one type of ecosystem service are likely to have effects - positives or negatives - on the others (FAO, 2007). Therefore, the quality or quantity of services provided is directly affected by resource use decisions made by ecosystem managers (Jack et al., 2008) such as farmers, fishermen and forest dwellers. As their decisions usually focus on short-term financial returns, they tend to supply more of the services that generate direct profits: the provisioning services that are commodities with well-structured markets. The other types – here called “Environmental Services¹” (ES) - are currently undervalued or have no economic value at all. As they

¹ The terms “Ecosystem Services” and “Environmental Services” are commonly found as synonyms in literature. Most of the publications focusing on the non-commodity services adopt the term “Environmental Services”. For this reason, the present work will use the term “Environmental Services” to refer to the subset of “Ecosystem Services” that exclude commodities.

cannot be bought and sold, ecosystem managers have no direct incentives to ensure their provision, even if they are vital to human well-being.

This market failure in incorporating the value of natural systems, and the services they provide, helps to explain why ecosystems are being lost. For millennia human societies have drawn benefits from nature without significantly disrupting its dynamics, but as populations grow and human activities increase, ecosystems are starting to be severely affected. The MA (2005) calculates that over 60% of the world's ecosystem has been degraded.

Not surprisingly, disruption and loss of ES have illuminated their importance (Daily, 1997). Several of the services in decline are critical for sustaining the long-term well-being of human societies (Foley et al., 2005), and recent studies have highlighted their importance to global economy (Costanza et al., 1997; Daily et al., 1997). In addition, the cost and technical limitations of developing manmade substitutes for ecosystem services make conservation reasonable from an economic point of view (Daily, 1997). For these reasons, safeguarding the biological diversity and the natural capital that support ES provision has become a global concern.

Traditionally, environmental policies have focused on “command-and-control” methods such as restriction on resource access and land uses, penalties, and taxation. Although these approaches help to slow down the degradation of ecosystems, they have been, in general, susceptible to growing pressures and demands, and have had insufficient success in achieving long-term conservation (MA, 2005). The MA (2005) highlighted that reversing ecosystem loss while meeting demand for their ecosystem services requires substantial changes in policies, institutions, and land use practices, which are not yet observed. In view of these insights, much has been debated about the need for new conservation paradigms.

Economic instruments are new promising policy tools for environmental conservation. Rather than following the traditional strategy of setting explicit rules, they operate on a decentralized level, inducing behavior changes in response to impacts on market signals (Stavins, 2001). “Payments for Environmental Services” (PES) is an incentive-based economic instrument that has been the center of the calls for new conservation approaches. Basically, PES schemes are arrangements through which beneficiaries of ES pay individuals or communities to undertake practices that increase levels of desired services (Jack et al., 2008). The idea behind PES is to make environmentally-friendly practices economically attractive to resource managers by internalizing the benefits they generate for society as environmental externalities. Stakeholders are then expected to adopt more sustainable practices on a voluntary basis, encouraged by the new economic perspective for conservation. This policy tool differs substantially from traditional conservation approaches because, instead of presupposing win-win solutions, it accepts the existence of hard trade-offs and tries to realign conflicting interests through compensation (Wunder 2005).

The cork oak woodlands found in southern Portugal, *the Montados*, are currently under threat and in need of innovative policy tools such as PES. *Montados* are agro-silvo-pastoral systems with high conservation value due to the several ecosystem services they provide and the high species diversity they sustain. Their ecological stability is highly depended on the maintenance of traditional management practices, but these practices have become economically unviable due to recent changes in the context for Portuguese agriculture. Developing novel ideas to maintain the economic viability of sustainable land uses in the long run is the main challenge for conserving this landscape. Conventional conservation approaches have shown inefficiency (Pinto-Correia 2000), and PES has been considered as

alternative conservation strategy. The idea is to reward sustainable management practices by compensating landowners for clearly defined targets linked to ES provision.

However, although the logic behind PES is not difficult to understand, the actual development and implementation of a program is a complex task. Programs must be tailored to specific local conditions, and adapted to different ecological, socioeconomic, and political contexts. Moreover, deliberated design options may highly influence the way this instrument operates. Hence, proposing PES requires a consistent understanding of this instrument, as well as of the target service and the context for implementation. The present work tries to address these issues in order to propose PES as a conservation tool for the *Montado* ecosystem.

1.1 Objectives

This study aims to help optimize the application of PES as a conservation tool for threatened ecosystems. More specifically, it intends to propose PES as a policy instrument for securing the economic viability of a sustainable land use system in Portugal, the *Montados*. For this, it focuses on assessing the potential of three different types of PES schemes to *Montados*. The goal of the assessments is to highlight important aspects and challenges involved in the implementation of the policy tools, in order to provide guidance and advice to policymakers and project developers.

The following strategy was adopted in order to attain the objectives mentioned:

- Conducting a solid literature review of the target ecosystem and the proposed instrument;
- Assessing *Montado*'s potential to supply ES and the current demand for its services;

- Searching, among the existent types of schemes, PES that fit both *Montado*'s characteristics and the insights from the supply-demand analysis;
- Learning from practical, relevant experiences by analysing implemented PES through a case study approach;
- Elucidating the potential of selected PES-schemes to *Montados*, based on the previous analyses;
- Highlighting important aspects and challenges that one is expected to face when implementing PES to *Montados*.

As side objectives emerging from the tasks listed above, this work also aims:

- (i) To help understand the socio-ecological problems faced by *Montados*;
- (ii) To highlight the advantages and drawbacks of applying PES and the main barriers for the implementation of this instrument;
- (iii) To help understand the particular aspects influencing the operation of PES-schemes, especially in view of the lack of publications that systematically document the effectiveness of PES programs.

1.2 Report structure

Chapter 2 presents the target ecosystem of this study, the Portuguese *Montados*. It briefly explains how *Montados* have evolved as a human-shaped ecosystem, and gives an overview of its main characteristics. Management dynamics are explained, with emphasis on the system's human-dependence for well functioning. Following, an analysis of the direct and indirect benefits generated by *Montados* draws attention to its socio-economic, historical and cultural importance, as well as to its ecological relevance in terms of biodiversity and ecosystem service provision. The chapter ends discussing *Montado*'s current threats and the need for innovative conservation approaches.

Chapter 3 focus on “Payments for Environmental Services” (PES), the economic instrument here proposed as a conservation tool for *Montados*. It starts explaining how PES and other incentive-based mechanisms can make conservation economically attractive to landowners and help to halt ecosystem loss. Then, relevant background information is provided, which includes: the definition of PES, the basic structure of a scheme, the types of PES currently in use, the main groups of ES targeted, and the advantages and drawbacks of this policy tool. As proposing PES also demands a solid background in aspects of policy design, the final part of Chapter 3 discusses issues that must be taken into account when designing a PES programme, highlighting their influence on environmental outcomes.

Proposing PES to *Montados* requires an assessment of its potential to provide ES, as well as of people’s willingness to pay for the services provided. For this reason, **Chapter 4** analyses *Montado*’s ability to supply, in the modes of a PES scheme, the three major groups of ES sold to date: *biodiversity protection*, *climate regulation* and *watershed services*. It also examines current demand for these services and highlights limitations to the implementation of the instrument. During the analysis, the necessary background information to understand the ES discussed and their respective markets is provided. This section concludes that *Montados* could be included in PES schemes focusing on *biodiversity protection* and *climate regulation services* (carbon sequestration and storage).

Chapter 5 complements the previous theoretical analyses with an overview of practical aspects of PES. The idea is to learn from previous experiences through a case study approach. The mechanisms selected for *biodiversity protection* and the respective case studies were: Environmental Certification, represented by The Biodiversity and Wine Initiative (South Africa); and Payments for Environmental Stewardship (under Agri-

environmental Schemes), represented by The Environmental Stewardship Scheme (United Kingdom). For *carbon sequestration and storage*, The Scolel Te Project (Mexico) was chosen to represent small-scale carbon forest project targeting voluntary markets.

Chapter 6 represents the final outcome of this work, where is analysed the potential of the three selected instruments to *Montados*. This is done based on all the information reviewed through this document, especially the lessons learned from case studies analysis, and on complementary literature review about the mechanisms selected. This chapter also aim to elucidate the main challenges emerging from the implementation of the tools selected in order to provide guidance and advice to policymakers and project developers.

The conclusions drawn from this work, as well as recommendations for future developments, are outlined in **Chapter 7**.

Chapter 2

The *Montado* Ecosystem

Over the past 10 000 years the Mediterranean basin has observed a complex “coevolution” between natural ecosystems and human societies (Blondel, 2006), which has resulted in unique landscapes with high cultural and conservation value. Continuous land and resource management that included, among others, domestication of species, water management, controlled burning and livestock husbandry, led to substantial changes in species diversity and ecosystem functioning, creating sustainable human-shaped systems (Blondel, 2006). Although some may argue that human activity has caused degradation of the Mediterranean basin (Thirgood, 1981; McNeil, 1992), many scientists point out that human presence contributed for maintaining landscape diversity in the region (Fabbio et al., 2003; Blondel, 2006). Indeed, the Mediterranean basin is considered nowadays as a biodiversity “hotspot” (Myers et al., 2000).

The oak woodlands found in southern Portugal, the *Montados*, are human-shaped savanna like ecosystems that have shown notable stability, biodiversity, and constant productivity over centuries (Blondel, 2006). These are agro-silvo-pastoral system, where the manager combines diverse types of land-use, working resources and ways of production, in order to obtain products from forest, agriculture and animal grazing (Belo et al., 2009). *Montados* are the output of long-lasting management practices aiming at optimizing annual fluctuation in productivity due to the strong climate and environmental stress (*e.g.* fires; droughts) typical from the Mediterranean region (Perez, 1990).

2.1 Characteristics

The *Montados* cover about 1.125 million hectares of the Portuguese territory (IFN, 2007), representing the main land use of the Alentejo region (Figure 1). They are two layered systems characterized by an open tree cover of cork oak (*Quercus suber*) and holm oak

(*Quercus rotundifolia*), found in monospecies or mixed stands, usually unregularly distributed and ranging in density from 20 to 80 trees per hectare. More rarely, they can include deciduous oaks (*Q. faginea* and *Q. pyrenaica*) and olive or sweet chestnut trees (Pinto-Correia & Mascarenhas, 1999). The understory is usually composed of culture (*e.g.* cereals, herbs and vegetables), fallow and pasture in rotation scheme (Pinto-Correia, 1993; Peco et al., 2006).

Environmental factors, such as tree type and soil quality, as well as the landowner exploitation aims will determine the contribution of products from forestry, agriculture and animal grazing to the economy of each *Montado* property (Palacín, 1994). These aspects will also substantially influence the composition of the understory and its rotation scheme (Picão, 1983). In general, the main economic activity is the production of cork, mostly used as wine bottle stoppers. The sustainability of this activity relies on the high regeneration capacity of cork oak trees, which start forming a new bark layer as soon as cork is harvested (Bugalho et al., 2011). Livestock is another important output, and is the main economic activity in areas dominated by holm oaks (Pinto-Correia & Mascarenhas, 1999). Animal husbandry includes pigs, sheep, goats, and cattle. Annual or perennial crops, such as oats, barley, wheat, and other herbs and vegetables are sometimes cultivated during a year, and crops are sold or used as fodder (Pinto-Correia & Mascarenhas, 1999; Blondel, 2006).

The agro, silvo and pastoral elements of *Montados* are related and depend on each other, creating an almost closed system. For instance, livestock can be nourished exclusively with *Montado's* products: natural pasture complemented with masts and acorns from the trees, and sometimes with part of the crops produced (Pinto-Correia, 1993). The number of

animals must be limited to the capacity of the system to provide nourishment, and to allow regeneration of the tree cover. However, grazing plays an important role in soil fertilization and shrub control (Pinto-Correia & Mascarenhas, 1999). Trees provide important outputs, such as wood and cork, and also shade for cultures during the harsh summer (Blondel, 2006). Correct management is essential to ensure the well functioning of the system and the provision of the target outputs. It has to ensure the balance between the different components by planning their density, spatial and temporal distribution (*i.e.* rotation patterns), stock growth and age of harvesting, as well as by respecting regeneration intervals (*e.g.* tree regeneration; soil recovering), promoting periodical removal of encroaching shrubs and gathering the outputs (Pinto-Correia, 1993; Fabbio et al., 2003).

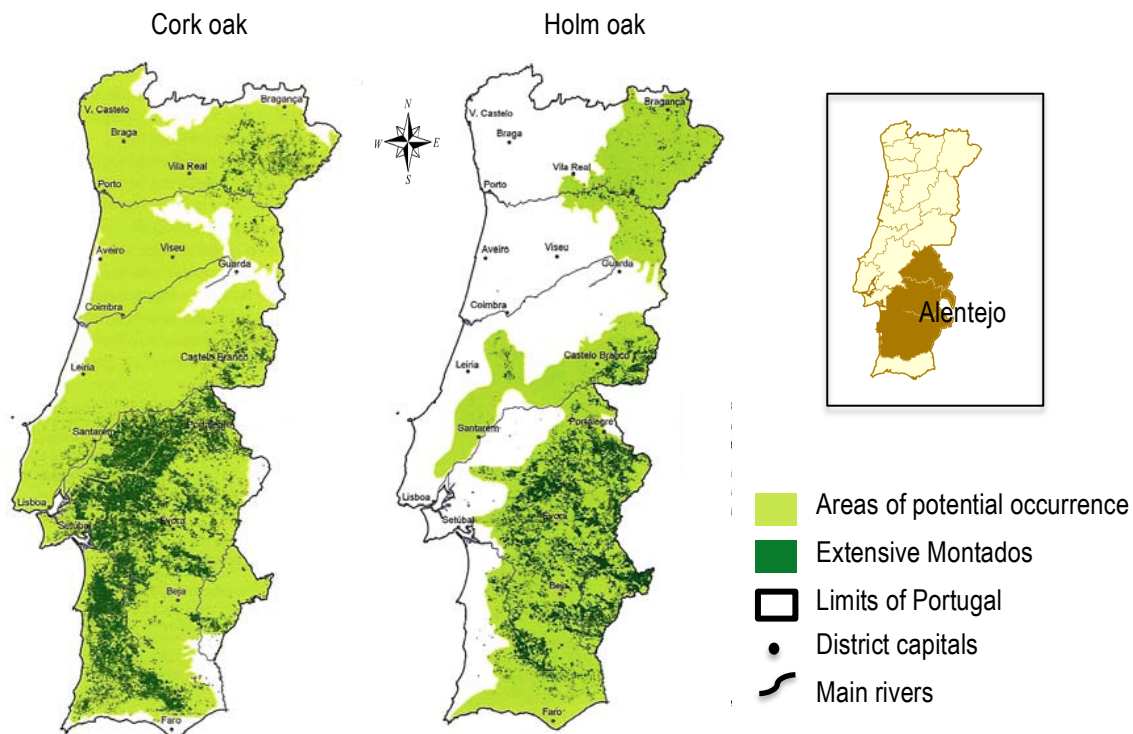


Figure 1. Distribution of cork and holm oak *Montados* in continental Portugal (adapted from Capelo, J. & F. Catry, 2007). The location of the Alentejo region is shown on the top right corner.

2.2 Conservation value

Montados are worth conserving not only because of their marketable outputs, but also due to the socio-cultural benefits and important ES they provide. These systems have persisted for many centuries without leading to depletion of resources, representing an important example of land exploitation where sustainability was achieved and ecosystems functions were maintained (Blondes, 2006). Following, the most relevant benefits obtained from *Montados* are presented.

2.2.1 Direct benefits

2.2.1.1 Cork and livestock production

Portugal is the world leader in the production of cork, which is estimated at $170 \text{ Kg ha}^{-1} \text{ yr}^{-1}$ (DGRF, 2006). It corresponds to 54% of the annual world production, and to 2.7% of total Portuguese exportations, generating around € 853 million per year (data from the year 2007; in Belo et al., 2009). Most of cork (70%) is used as wine bottle stoppers, but it can also be used to manufacture other products, such as: pavements, coverings and insulation, expansion joints for civil engineering, shoes, and musical instruments (Pereira et al., 2008). Cork production from *Montados* and forests in Portugal generates around 12 000 direct job posts in the industry and 6 500 jobs in forest exploitation (Pereira et al., 2008). Besides, *Montados* create thousands of employment positions related to its other products and services, such as livestock farming, tourism and recreation and harvesting of other forest outputs (Pereira et al., 2008).

Livestock production is an important economic activity from *Montados*. The indigenous Iberian pig (in Portuguese, *porco da raça alentejana*) represents the main animal output, however, cattle, sheep and goats also contribute to the economy of the system. The

productivity of Iberian pig is now being reestablished, after it almost disappeared in the sixties due to the spread of swine fever (Pinto-Correia, 1993). According to the Portuguese Millennium Ecosystem Assessment (Belo et al., 2009), in 2007 there were 11 612 registered reproductive units of this pig breed, distributed over 200 000 hectares of *Montados*, and 24 registered brands associated with it. It is estimated that 23 000 Iberian pig were raised in 2007/2008, which is still representing only a small part of the potential of the region (around 63 946 animals were raised in 2006).

Besides cork and livestock, there are other direct products from *Montados*, both from animal origin (e.g. skin and wool) and from forest (e.g. firewood, medicinal and aromatic plants; mushrooms), with potential commercial value if correctly exploited.

2.2.1.2 Socio-cultural benefits

The existence of *Montados* dates back to the beginning of the XIX century, however, these systems started to be shaped by humans in ancient times (Belo et al., 2009). Their continuity throughout history coupled with a long tradition of human uses make these landscapes part of the European historical and cultural patrimony, and part of the identity of the Mediterranean basin (Pereira et al., 2008; Pinto-Correia, 2000). As *Montados* are still maintained with traditional management practices, they are considered an important representation of national traditions.

The biodiversity-rich landscape mosaic formed by this ecosystem is also high valuable for tourism and recreation purposes. Some of the reasons motivating people to visit these areas are: to appreciate landscape beauty, to rest, and to get in touch with the traditions and typical gastronomy of the region (Jesus, 2002). Ecotourism and hunting are also recreational activities responsible for attracting people to these areas. Hunting has high

potential as a strategy for diversifying economy and promoting sustainable development in the Alentejo region (Coelho & Oliveira, 2010). Free hunting was allowed in Portugal until 1986, when Law no. 30/86 established the creation of Hunting Zones to be managed by different agents (*e.g.* private sector, associations, municipalities). Recent data from the National Forest Authority (AFN, 2011) indicates that there are around 829 Touristic Hunting Zones in the Alentejo, which represents more than 80% of the total in Portugal. Examples of game species found in *Montados* are the Red-legged Partridge (*Alectoris rufa*), the Iberian hare (*Lepus granatensis*) and the Quail (*coturnix coturnix*) (Belo et al., 2009).

2.2.2 Indirect benefits

2.2.2.1 Biodiversity protection

The mosaic-like design of *Montados* highly contributes to the biodiversity richness of this ecosystem (Branco et al., 2010). The natural and semi-natural elements present and connected to each other (*i.e.* shrub lands, pastures, meadows, forest and agriculture fields) result in the coexistence of a variety of habitats, which support several species (Fabbio et al., 2003). Furthermore, the spatial co-occurrence of different vegetation structures well separated vertically (two-tiered vegetation structure) allows the existence of both species typical from forest, and those associated with open areas such as agriculture and grassland. Other reasons for the high species diversity found in *Montados* are: i) the dominant trees is indigenous, longevous, and associated with indigenous and diverse invertebrate fauna; ii) the existence of hundred thousands hectares of this ecosystem, a large continuous or little fragmented area; and iii) the fact that both cork exploitation and agro-pastoral production

are still using traditional techniques, which causes little environmental impact (Belo et al., 2009).

It is possible that species typical from closed habitats (*e.g.* bushes and forests) were negatively affected during the formation of *Montados*, when large areas of forests were cleaned for pastures and crops (Belo et al., 2009). However, this process favoured native species from shrubby and grassland habitats, which were able to colonize those cleaned areas and increase biological diversity at landscape level (Blondel, 2006).

As reviewed in the Portuguese Millennium Ecosystem Assessment, fauna diversity in *Montados* is greater than in most of the other forest or agricultural systems in Portugal. Blondel & Aronson (1999) highlight that both alpha (*i.e.* site diversity; species richness within a particular area) and gamma diversity (*i.e.* geographic scale diversity; landscape level) are high in *Montados*, and Belo et al. (2009) estimates that more than 130 species of vertebrates live and reproduce in this ecosystem, from which 75 are birds, 28 mammals, 10-15 reptiles and 5-7 amphibians. Among all terrestrial ecosystems in Portugal, only riparian environments show superior numbers.

Montados are particularly important for bird species, hosting substantial part of several populations found in Portugal, such as: Honey Buzzards (*Pernis apivorus*); Orphean Warblers (*Sylvia hortensis*); Common Redstarts (*Phoenicurus phoenicurus*); and the Lesser Spotted Woodpeckers (*Dendrocopos minor*) (Belo et al., 2009). Moreover, several birds of prey nidify in *Montados*, as for instance the Imperial Eagle, the Short-toed Eagle (*Circaetus gallicus*), the Booted Eagle (*Hieratus pennatus*), and the Bonelli Eagle (*Hieraaetus fasciatus*) (Onofre et al., 1999). Over-wintering bird populations also profits from this ecosystem: it is estimated that approximately 70 000 Eurasian Cranes (*Grus grus*)

and 6 million woodpigeons (*Columba Palumbus*) are attracted to the Iberian Peninsula, partially due to acorns from oak trees (Díaz et al., 1997).

Floristic diversity is also notable in *Montados*. Díaz-Villa et al. (2003) estimated that more than 135 species of vascular plants can be found per 0.1 ha of *Montado*, including Portuguese endemic species such as *Ononis hackelii* and the grass *Avenula hackelii*. Furthermore, a substantial turn over of plant species composition is observed between years, which is due to the fact that the majority of herbaceous species forming the understory grassland is annual (*i.e.* grow and reproduce within an year) and spend the hot and dry summer as seeds buried in the soil (Bugalho et al., 2011).

Although none of *Montado*'s species are exclusive to this ecosystem, some of them are endemic to the Iberian Peninsula (see Appendix). Furthermore, this landscape provide habitat for threatened species such as the Iberian Lynx (*Lynx pardinus*), the feline most critically threatened in the world, and the Imperial Eagle (*Aquila adalberti*), which nidifies in the trees and hunts in open areas (Pereira et al., 2008). Other examples of threatened and endangered species are presented in the Appendix.

In regards to the high species diversity described above, many areas of cork and holm oak woodlands are classified as protected or sensitive areas under different networks for nature conservation. *Montado* sites have been classified as protected ecosystems within the Natura2000 network, a European Union-wide network of areas for nature protection (EC, 2011a). There are also several sites included in the National Network of Protected Areas (RNAPs) or considered “Ramsar sites” (*i.e.* included in the List of Wetlands of International Importance of the Ramsar Convention on Wetlands) (Branco et al., 2010). Besides, the region where this ecosystem occurs, the Mediterranean Basin, is a hotspot for

biodiversity conservation (Myers et al., 2000), hosting more than 25 000 plant species, half of which are endemic, and several endangered vertebrates (Branco et al., 2010).

2.2.2.2 Carbon sequestration and storage

Storage of carbon in biomass is one of the most recognized ecosystem services from forests. In view of the current threat of global warming to world's ecosystems and economies, the critical role of forests in subtracting carbon dioxide from the atmosphere and, thus, mitigating anthropogenic impact on climate stability has become widely studied. The Kyoto Protocol (COP, 1997) established commitments for industrialized countries to reduce Green House Gas (GHG) emissions, and Portugal has committed not to increase its emission in more than 27% (using 1990 numbers as reference) (IA, 2006). Understanding how Portuguese ecosystems contribute to carbon storage is crucial for achieving this commitment.

The structural complexity of *Montados* (i.e. presence of two vegetation layers) complicates the assessment of its overall carbon sequestration capacity (Potes, 2010). However, studies have recently been conducted to estimate the role of holm oak, and especially cork oak trees in carbon storage. Branco et al. (2010) used data from the Portuguese Forest Inventory (Tomé et al., 2007) to estimate the total carbon stock derived from cork oak forest. According to the authors, cork oak stands from the entire Portugal are responsible for storing 14 748 500 t CO₂, from which 14 030 787 t CO₂ are derived from the area in the south of Tagus River (where *Montado* is the main land use). They have also quantified average values per hectare for three types of cork oak stands. While pure cork oak stands are estimated to store 22 t CO₂ ha⁻¹, mixed dominant stands and mixed-non-dominant stands store 16 t CO₂ ha⁻¹ and 11.5 t CO₂ ha⁻¹, respectively.

Pereira et al. (2007) investigated carbon productivity of *Montados* and other two Mediterranean ecosystems as part of the CarboEurope-IP project. They measured net carbon productivity between the years 2003-2006 in an evergreen oak woodland with approximately 21% of tree crown cover, and found out that this areas may sequester up to $140 \text{ g C m}^{-2} \text{ yr}^{-1}$ (or $5,13 \text{ t CO}_2 \text{ ha}^{-1} \text{ yr}^{-1}$). Taking into account that 2005 was a very dry year, annual carbon retention may be even higher, not differing much from a similar forest (e.g. *Quercus douglassi* with 40% tree coverage) in California, where carbon productivity reaches $5.72 \text{ t CO}_2 \text{ ha}^{-1} \text{ yr}^{-1}$ (Pereira et al., 2008).

Cañellas et al. (2008) estimated the amount of carbon expected to be sequestered during the first commitment period of the Kyoto Protocol (2008–2012) by cork oak plantations established after 1990. Rate of planting considered was based on official statistics (Ferreira et al., 2006) for the period 1995–2003, which is of the order of $9\,300 \text{ ha}^{-1} \text{ yr}^{-1}$. According to their results, new plantations may sequester up to 1.4 Mt of CO_2 ($1.4 \times 10^6 \text{ t CO}_2$), which represents a large part of the total value estimated considering all forests in Portugal.

Some may argue that low tree density limits *Montado* potential of carbon sequestration. Indeed, Pereira et al. (2007) found these systems to be weaker carbon sinks than other ecosystems such as eucalyptus forests and grasslands. However, one must take into account that oaks are long living trees that can store carbon for long periods (over 100 years), and that their main exploitation product (cork) is harvest without killing the trees. Luyssaert et al. (2008) highlighted the importance of old-growth forest, such as oak-woodlands, as carbon sinks. Their study showed that these forests continue to sequester atmospheric carbon dioxide over time, contrary to the old view that they are carbon neutral because they cease to accumulate it. Furthermore, they contain vast quantities of carbon, resulting from

centuries of retention, which will be released into the atmosphere if severely disturbed. For these reasons the authors stress the need for considering conservation of old-growth forest in forest carbon-accounting rules.

2.2.2.3 Water cycle regulation and soil protection

Oak trees play an important role in regulating water cycle and protecting against soil erosion. These are particularly important ES considering that in the Iberian Peninsula water is scarce and expected to become even scarcer (Schroter et al., 2005). The Mediterranean region is classified by the United Nations Convention on Combating Desertification (UNCCD, 1994) as vulnerable to desertification due to its climate, soil type, terrain, vulnerability to fires, and unsustainable use of water resources. The term desertification refers to land degradation (*i.e.* reduction or loss of the biological or economic productivity and complexity of vegetation cover) occurring in arid and semi-arid regions, resulting from, among other factors, climatic variations and human activity (UNCCD, 1994). Portugal is considered one of the European countries most affected by desertification, in part due to its long and dry summers (3-5 dry months per year) followed by heavy precipitations, which wash sediments and provoke soil loss (Rego et al., 2008).

Montados contribute to halt land degradation because their forest component increases the organic matter content in the soil. Oak tree roots extract nutrients from deep soil layers and transform it in organic matter in the photosynthesis process (Natividade, 1950; Rego et al., 2008). Nutrients are returned to soil as organic matter when leaves fall off and accumulate in its surface. A high organic matter content enhances water infiltration and decreases rainfall loss in surface runoffs, which helps to regulate the hydrological cycle (Rego et al., 2008).

The role of oak trees in increasing water retention was highlighted by Branco et al. (2010), who verified that areas with medium to high recharge rates in the aquifer *Margem Esquerda* (Tejo-Sado River Basin) overlaps with cork oak distribution. As this aquifer is recharged mainly by atmospheric precipitation, it might be highly affected by forest cover and management.

2.3 Montados under threat

Montados are currently under economic stress, facing risk of severe degradation and disappearance. Traditional management practices responsible for maintaining this ecosystem have become economic unviable, mainly due to changes in the context for Portuguese agriculture and to the decrease in the economic value of some products (Pinto-Correia, 1993). Intensification and extensification of land use, sometimes resulting in land abandonment, are leading to simplification of the landscape and loss of biodiversity, threatening *Montado's* ecological stability, production potential, and capability of maintaining the rural population (Pinto-Correia, 1993; Pinto-Correia 2000; Fabbio et al., 2003).

The decline in cereal cultivation after the opening to international markets, and the following fall in crop prices substantially contributed to extensification (*i.e.* the process of decreasing the use of capital and inputs relative to land area. EC, 2010), and to land abandonment (Pinto-Correia, 2000). Other drivers of changes in land use were the increase in agriculture wages coupled with migration from the countryside, which made those management practices relying in low-cost manual work (*e.g.* shrub clearing) economic unsustainable (Pinto-Correia, 2000). The substantial decrease in Iberian pig (*Porco da Raça Alentejana*) population in the sixties, due to the spread of African swine fever, was

also responsible for the abandonment of traditional production system. It led to the adoption of alternative production strategies that included intensification of cultivation in the most fertile soils, abandonment of agriculture in other area, intensification of cork production or clearance of the tree cover for cultivation (Pinto-Correia & Mascarenhas, 1999).

Cork, which is considered the only product from *Montado* that still competitive and the main economic incentive to human management, is also facing market instability (Belo et al., 2009). Approximately 70% of cork production is used as wine bottle stoppers and has now to compete with growing use of synthetic materials and screw caps in the wine industry (Branco et al., 2010). Moreover, both intensive extraction of cork and abandonment of careful management practices are negatively contributing to the sustainable production of this item (Pinto-Correia & Mascarenhas, 1999). Branco et al. (2010) explains that *Montado* current economic instability results from its extreme resilience on a single market product, whose market is in jeopardy. The authors also point out that in areas where holm oak is the dominant tree type there is basically no output that sufficiently rewards traditional management practices.

Nowadays, agriculture subsidies are in part responsible for sustaining *Montados* (e.g. the EU agricultural funding) (Pinto-Correia, 1999; Bugalho & Rocha, 2007). However, in many cases these subsidy are not conditional on environmental conservation or ES provision, and can even have perverse consequences. For example, direct payments to farmers who own livestock may encourage overgrazing and compromise tree regeneration (Bugalho et al., 2011). Even subsidies aiming at conserving ecosystems and traditional landscapes (i.e. Agri-environmental schemes established under the European Union's

Common Agricultural Policy), have shown little success, either because their targets are ill-defined or because farmers can still receive greater payments by moving towards other production systems (*e.g.* forest plantations) (Pinto-Correia, 2000; Bailys et al., 2008).

Developing innovative ideas and schemes that can help maintain the economic viability of *Montado* in the long run is the main challenge for conserving this landscape. As explained above, remunerating sustainable forest management indirectly, through markets for traditional outputs, has proved insufficient. Conventional conservation approaches and subsidies have also shown inefficiency (Pinto-Correia, 2000). A novel promising approach is the implementation of Payments for Environmental Services that would remunerate sustainable management practices *per se* by compensating landowners for clearly defined targets linked to ES provision.

Chapter 3

Payments for Environmental Services

3.1 What are Payments for Environmental Services?

The type, quality and quantity of ecosystem services provided are directly affected by resource use decisions made by ecosystem managers such as farmers, fishermen and forest dwellers. However, most ES cannot be bought and sold, creating no direct economic incentive for resource managers to undertake production practices that ensure provision of these services. Furthermore, many times the benefits generated by ES are positive externalities, flowing primarily to others rather than to those making management decisions. As a result, there is a misaligning of public interests and the private interests of the ecosystem manager, where the latter tends to provide too little of the services desired by the former (Jack et al., 2008). This market failure in incorporating environmental values, or the problem of externalities, explains why most of ecosystems and their respective services are currently under pressure.

“Payments for environmental services” (PES) is an incentive-based mechanism whose main goal is to make conservation economically attractive to landowners and resource managers by internalizing the benefits they generate for society. Basically, PES are transactions that reward individuals or communities for undertaking actions that increase the levels of desired ES (Gundimeda & Wätzold, 2010). In other words, those who use a certain service pay those who ensure its provision, making environmentally-friendly practices more economically attractive. An example would be upstream landowners receiving payments from downstream service users (*e.g.* those interested in water for domestic use or irrigation, recreation, fisheries, etc.) as a reward for land-uses that do not jeopardise water quantity and quality.

Therefore, the idea is to induce behavioural changes in ecosystem managers through the creation of new economic incentives, rather than following the traditional approach of setting explicit rules. Stakeholders are expected to adopt more sustainable practices on a voluntary basis, encouraged by the new economic perspective for conservation. This policy tool differs substantially from traditional conservation approaches because, instead of presupposing win-win solutions, it accepts the existence of hard trade-offs and tries to realign conflicting interests through compensation (Wunder, 2005). For instance, as illustrated in Figure 2, by setting aside an area for forest conservation farmers may positively impact the provision of certain ES (*e.g.* climate regulation, biodiversity protection, water quality), but at a cost of decreasing crop productivity. Service users must then compensate service providers for their behavioural change and the consequent increase in services supply.

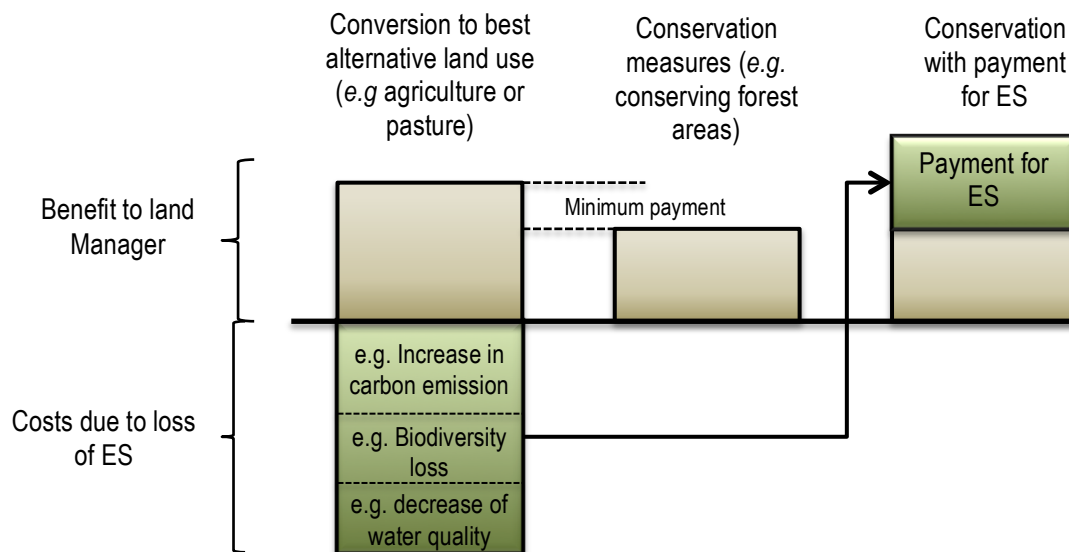


Figure 2. The logic of PES (Adapted from Pagiola and Platais, 2007; Engel et al., 2008; Arrigada and Perrings, 2009)

3.2 Defining PES

A formal definition of PES was first given by Wunder (2005): “A PES scheme, simply stated, is a voluntary, conditional agreement between at least one ‘seller’ and one ‘buyer’ over a well defined environmental service – or a land use presumed to produce that service”. However, in practice few payment schemes follow all Wunder’s rules, and several alternative definitions have emerged. The present study adopts the definition from the FAO (2010a) because it contains most of the common aspects between several definitions found in literature. According to it, PES are:

- i) Voluntary transactions where
- ii) a service provider is paid by or on behalf of service beneficiaries,
- iii) for agricultural land, forestry, coastal or marine management practices,
- iv) which are expected to result in continued or improved service provision beyond what would have been provided without the payment.

3.3 PES in practices

Although the logic behind PES is not difficult to understand, the actual application of this instrument is a complex task. PES-programs have to be tailored to specific local conditions in order to adapt to different ecological, socioeconomic, and political contexts. Furthermore, there are several design choices that have to be made when developing a scheme that will highly influence its outcomes. A simplified representation of a PES scheme is shown in Figure 3, however, this structure can highly vary due to the interactions with implementation contexts and design options (Engel et al., 2008). In fact, such interactions are the main factor determining the success/failure of PES in achieving proposed targets.

Developing a PES scheme must start with identifying ES prospects, which includes defining, measuring and assessing ES provided in the area, as well as determining their market value. In this regard, one crucial step for making PES work is to correctly understand the science behind ES provision, particularly the impacts of management activities in services outcomes. Understanding this link is necessary to make sure the services are actually been delivered (Forest Trends et al., 2008).

Other steps include identifying potential buyers and/ or sellers (depending on who is setting up the scheme); assessing institutional and technical capacity (*e.g.* existing regulations; ownership context; presence of any support organizations); and structuring agreements (*e.g.* determining the institutional framework; preparing contracts and other operational documents; creating a management plan) (Forest Trends et al., 2008).

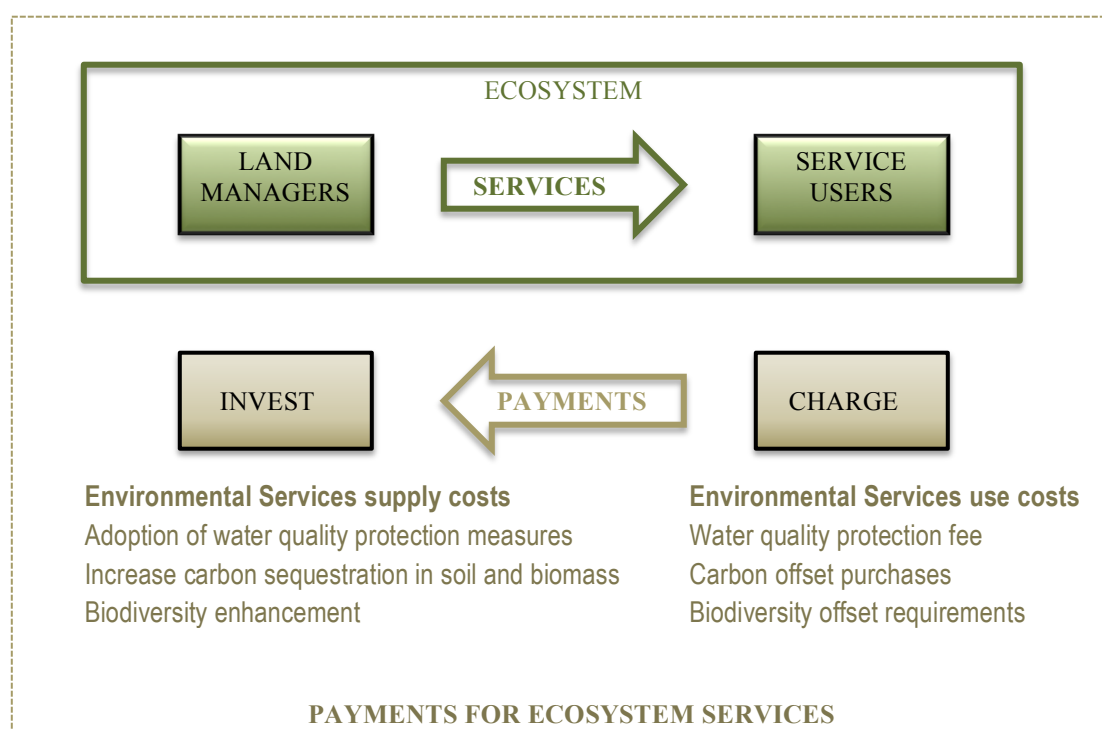


Figure 3. Simplified structure of a PES scheme (Adapted from FAO, 2010a).

3.4 What types of PES are out there?

PES schemes have been implemented increasingly often in both developed and developing countries (Wunder et al., 2008) and comprise a variety of mechanisms applied at different scales. They range from small-scale programs developed to solve specific problems (*e.g.* water consumers in a locality paying landowners upstream to protect watersheds; see Echaverria, 2004) to programs larger in scope, such as China's multi-billion dollar public payment scheme to fund erosion control (Gee, 2006). There are also international deals that fall under the concept of PES, as for instance the International Market for Carbon Trading.

Most of schemes tend to concentrate around three types of ES (FAO, 2010a; Wunder, 2005):

- **Carbon sequestration and storage;** especially in response to demand from voluntary and regulatory greenhouse gas emissions markets (*e.g.* Kyoto Protocol; European Union Greenhouse Gas Emission Trading Scheme).
- **Biodiversity protection;** referring to several deals to sponsor conservation of areas of important biodiversity (*e.g.* buffer zones of protected areas, biological corridors; remnant patches of native vegetation).
- **Water quality and quantity;** which can also include soil conservation measures in order to control erosion, sediment loads in rivers and reservoirs, and to reduce the risk of flooding.

There are payment programs that bundle ES, instead of focusing on a single service. Bundling services is a more holistic approach that can be used when ecosystem complexity make it difficult to delineating a single service. For example, PES targeting conservation of a native forested area may improve water quality and quantity, and at the same time protect biodiversity and enhance landscape beauty. In these cases, services can then be sold as a package or offered to different buyers separately (Kemkes et al., 2009).

In summary, there are six main types of PES-schemes currently in use, which are presented in Table I.

Table I. Most common types of PES (source: Forest Trends et al., 2007)

Direct public payments	<p>Government payments for the protection of specific ES through sustainable land management practices. They usually involve direct payments from government agency or other public institution to land managers. This is the most common type of PES found worldwide.</p> <p><i>e.g. The Conservation Reserve Program in the US pays farmers in exchange for their protection of endangered wildlife habitats, open space and/or wetlands (CB); In China, the government is investing US\$ 4.3 million a year in restoring erosion-prone sloping land to reduce the risk of flooding.</i></p>
Self organized Private deals	<p>Where buyers pay directly to the service provider, with little government involvement. Buyers may be private companies or individuals interested in improving quality of a specific service.</p> <p><i>e.g. In France, Perrier Vittel (now owned by Nestlé) signed long-term conservation contracts with owners of farmland surrounding their aquifers, in order to improve water quality. Farmers received compensation to adopt less intensive pasture-based dairy farming, improve animal waste management, and reforest sensitive filtration zones.</i></p>
Tax incentives	<p>Individuals receive tax breaks from the government in exchange for ensuring ES provision.</p> <p><i>e.g. In the US tax incentives encourage landowners to put part of their land under conservation easements.</i></p>
Regulation-Driven Open trading	<p>In response to the demand for a specific ES, in view of a new government regulation, such as setting a “cap” on the damage to an ES. Buyers may be companies, utilities or other institutions responsible for diminishing the service, which can comply by trading with those who are able to meet the regulation at lower cost.</p> <p><i>e.g. The International Carbon Trading Market: industrialized countries can trade carbon credits in order to meet their commitments established by the Kyoto protocol.</i></p>
Voluntary Markets	<p>Those are markets where buyers and sellers engage in transactions not in response to regulations or to meet mandatory caps, but for reasons such as philanthropy, social responsibility, public relations, risk management.</p>
Certification of Products	<p>Consumers pay a “green premium” in addition to the market price of a product, whose production process is certified to be environmentally friendly.</p> <p><i>e.g. The Rainforest Alliance and the Sustainable Agriculture Network certify coffee, bananas and other products grown around high-biodiversity-value areas;</i></p>

3.5 PES advantages and drawbacks

PES is just one of many incentive-based mechanisms that can promote environmental conservation, but it has attracted the interest of both private and public sector and become one of the most wide-spread conservation instruments. As ecosystems are being lost, ES previously provided for free are becoming increasingly threatened and even scarce, which makes them potentially tradable (Wunder, 2007). Not surprising, PES are in the centre of calls for new conservation approaches.

This instrument is attractive for policy makers because: (i) it represents a new source of income for conservation, restoration, and other activities related to sustainable ecosystem management; (ii) it is potentially efficient, as it increases the provision of services whose benefits exceed provisioning costs, and do not conserve services in the opposite situation; (iii) it is expected to be sustainable, as it depends on the mutual self-interest of service users and providers (although in many cases PES are financed by governments or donor funding) (Pagiola, 2006). The UNEP/IUCN (2007) highlight other advantages of this policy tool:

- It has the potential to raise awareness of the values of biodiversity and ecosystems.
- It provides an opportunity to engage previously uninvolved actors (especially in the private sector) in conservation activities.
- It creates opportunities for communities to improve their livelihoods through access to new markets.
- It is a potential platform to integrate conservation and climate efforts into a common policy framework.
- It has the potential to increase collaboration amongst Multilateral Environmental Agreements, in the international context.
- It facilitates the transition from an economy of production to an economy of stewardship.

The fact that such mechanism can work for poverty alleviation and increase equity strongly contributes to the popularity of PES. “Pro-poor PES” relies in the idea that the emergence of markets for ES creates a new source of income for landholders at the same time as they generate efficiency gains (FAO, 2010a). For example, there are many rural communities directly depending on natural resource-based activities, such as forestry and farming, which conduct unsustainable exploitation because there are short-term incentives for that. In certain contexts, PES can be design as new incentives to enable low-income people to earn money for sustainable management, or for restoring and conserving ecosystems. This would provide both supplemental income and additional employment in the community, promoting long-term sustainable use of resources and preventing critical loss of natural capital (Forest Trends et al., 2008). Nevertheless, some say that it may be counterproductive to expect that PES can address both environmental problems and poverty (Kolsoy & Corbera, 2010). Wunder et al. (2008) highlights that concentration of efforts on poverty alleviation can deviate payments from areas were they could actually make a difference in environmental conservation.

Other types of critics followed the rapid dissemination of the PES concept in both the scientific and political arenas. First, there are those who find it difficult to accept the creation of markets for nature, and fear the commodification of nature’s services. They argue that using a purely economic logic to tackle environmental problems can raise ethical dilemmas and be counterproductive for conservation (Vatn, 2000; Martinez-Alier, 2002; Gómez-Baggethun et al., 2010). Furthermore, technical problems in defining boundaries in ecological systems and addressing the complementarity of goods and services are expected to arise (Vatn, 2000). In this regard, there have been calls against the creation of markets

for nature's services and for keeping conservation based on aesthetical and ethical values (McCaulay, 2006).

Although these critics have fundament, nature is already an asset and the creation of markets seems almost inevitable when considering global ecosystems as providers of indispensable goods and services that have, undoubtedly, a real value for human societies. By creating value for environmental services, PES are doing more than creating markets for nature, but raising awareness for the critical importance of natural resources to the global economy (UNEP/IUCN, 2007).

Critics also point out that the rapid enthusiasm for PES was not followed by an equivalent understanding of practical issues behind the operation of this instrument (Landell-Mills & Porras, 2002). Indeed, there is lack scientific knowledge about the cause–effect relationship between certain land use practices and provision of ES, and there are several difficulties in the process of measuring and valuating them. PES is a relatively new mechanism that still poorly monitored, and publications discussing its effectiveness still limited.

In regards to the presented advantages and downsides of PES, it can be concluded that this instruments is not a “silver bullet” for tackling any kind of social and environmental problems, but a tool designed to address the specific set of problem mentioned in the beginning of this section: ecosystems mismanaging because many of their benefits are externalities from the perspective of ecosystem managers (Engel et al., 2008). In other words, PES must not be seeing as an end itself, but as a conservation tool with several advantages to be careful applied in particular situations where it can potentially achieve desired results (UNEP/IUCN, 2007).

3.6 Designing PES

The several existent PES schemes differ substantially with respect to design characteristics, which, together with the scenario of implementation, will determine the success of the instrument in reaching its environmental objectives. Variations include the type of services provided, the forms of economic incentive proposed, the stakeholders involved, and several aspects of the payment mechanism. A solid background in policy design aspects, and their influence in the way PES operates, is necessary if one wants to propose PES as a conservation tool. For this reason, the most relevant issues in PES design are following discussed.

3.6.1 Actors involved

The stakeholders involved in a scheme are basically the suppliers of services, the buyers and/or users of services, and possible intermediaries and facilitators.

Buyers

One important distinction among PES programs regards who the service's buyers are. In "user-financed" PES programs services are bought directly by the actual users, for instance a company buying carbon credits in order to offset its emissions. However, in many schemes a third party (*e.g.* the government, an NGO, or an international agency) is responsible for paying ES providers on behalf of users. These "government-financed" PES programs are commonly based on direct payments from government agency or other public institution to land managers (Wunder, 2005; Engel et al., 2008).

The distinction of both types is not so obvious in practice. Many government-financed schemes are funded by compulsory fees charged from service's users. For this reason, one may argue that users are financing the program rather than the government. In this regard,

Engel et al. (2008) argued that the distinction between “user-financed” and “government-financed” programs must take into account not only who is making payments, but also who has the authority to make decisions about payments. Thus, if the government makes all of a program design decisions, it should be considered government-financed, even if funded by users.

“User-financed” programs are usually smaller in scale, their focus is more local, and they tend to be implemented in situations where there is only a single buyer or the buyers are few (Wunder 2005; Engel et al., 2008). According to Pagiola & Platais (2007) this type of PES program is expected to be more efficient because: i) the actors involved are directly interested in ensuring that the mechanism is functioning well; ii) changes in the level of service provision is more directly felt, and iii) contracts can be re-negotiate (or ended) if needed. However, there are many cases where public-financed schemes are the only option, for instance when ES is a public good (*i.e.* a good or service that is non-rival and non-excludable), such as biodiversity, and it is basically impossible to identify and delimit users (non-excludability). Government-financed PES can overcome any “free riding behaviour” that is likely to emerge by charging compulsory fees. Furthermore, government and other institutions participating in a public-financed scheme can play an important role in reducing transaction costs that is expected to increase as the number of buyers increases (Engel et al., 2008).

Sellers

In general, ‘sellers’ of an ES are those who are able to ensure the provision of the ES. In most of the cases, they are private landowners. Porras et al. (2008) identified other categories of suppliers being paid in PES schemes, such as: informal occupiers of public

lands (*e.g.* farmers living on public land, usually part of a national park or other type of protected area); communal landholders (*e.g.* when communities have joint property rights and/or land management rights, which makes them collective ES providers); and governments or NGOs managing protected areas (*e.g.* when national parks receive payments).

Intermediaries

Ideally a PES deal should include only buyers and sellers, as the involvement of intermediaries may increase transaction costs (see section 3.6.2). In practice, however, only very few schemes do not use the help of a facilitator at some stage. In most of the cases, the involvement of a third party is necessary to link supply and demand actors, and enable a payment scheme to develop and operate (Porrás et al., 2008). A common situation is when providers are several, and dispersed in the landscape, which makes working with them logistically complicated. In this cases, intermediaries may be responsible for communicate the offered payments, contract with the interested providers, monitor compliance, and make payments (Wunder et al., 2008).

Intermediaries are usually government bodies, NGOs, donors or institutions created by the PES programme, whose level of involvement and responsibilities vary according to the type of scheme and context of implementation. They can act at different stages, such as design, support and administration. For instance, they can facilitate dialogs between sellers and buyers, help designing payments mechanism, estipulate contract, give technical support, and manage funds and take responsibility of monitoring. Intermediaries may also act as a wholesale manager, buying services from providers and offering to potential buyers (Gundimeda & Wätzold, 2010).

Program developers

The final shape of a PES programs will be highly influenced by who had the initiative to start up the deal and why. Schemes can be development by interested ES buyers, seller or by a third party, such as local governments or NGOs, trying to resolve environmental problems. Side objectives such as rural development, poverty alleviation or specific political interests are commonly included in PES deals and will also contribute to the final structure (Engel et al., 2008).

3.6.2 Payment mechanism

How much to pay?

The basic logic for establishing payments is that the compensation offered to ES providers must exceed the opportunity cost (*i.e.* what they would possible achieve if adopting other land-uses, such as agriculture or animal husbandry), otherwise they would not change their behaviour, and must be restricted to value of the benefits to ES users (or users would not be willing to pay for it) (Engel et al., 2008).

Payments must also comprise other costs of the program, such as transaction costs. This term refers to costs encountered by buyers, providers and other actors, to implement and run a PES scheme. It includes, for instance, the costs for collecting information; negotiating with actors involved, designing contracts, monitoring and enforcing compliance, as well as administrating payments. In summary, the two main reasons behind transaction costs are: the need of specific information for a program to function (*e.g.* understanding the link between land use practices and ES provision); and the logistical costs of putting into practice a PES transaction (Wunder et al., 2008). Transaction costs are usually determined by: i) the size of the scheme; ii) the number of parties included; iii) the complexity of the

contracts; iv) the mode of payments; and v) the monitoring approach (Gundimeda & Wätzold, 2010). As these costs represent a great share of the total expenditure of the program, they may highly influence its cost-effectiveness and threaten the program's viability if underestimated (Landell-Mills & Porras, 2002; Gundimeda & Wätzold, 2010).

How to pay?

PES are not necessarily attached to monetary transactions. Although the most common form of compensation is in cash payment, schemes may include non-monetary types of compensations, such as strengthened property rights or temporary permission to manage ecosystems. Forest Trends et al. (2008) outline four types:

- Direct financial payments, usually compensation for opportunity costs or loss of livelihood incurred by ES protection, such as the conversion of managed farmland to natural forest.
- Financial support for specific community goals, such as building of a school or clinic to remunerate for ES provision.
- In-kind payments (*e.g.* provision of inputs for agriculture; provisioning seeds in reforestation programmes).
- Recognition of rights, such as increased land rights and increased participation in decision-making processes.

Payments may also differ in timing: they can be one-off or periodically made. One-off payments may be sufficient when participating landowners face income losses in the initial stage of the programme, but experience high-returns in the long-term. However, if land-use change as part of the programme does not generate sufficient long-term returns, the best option is continuous or fixed-period cash payments (Gundimeda & Wätzold, 2010). A combination of both types can also be applied.

What is been paid for?

As stated in the definition of PES, payments must be conditional to ES provision. This mechanism does not comprise monetary transactions that are not conditional on either ES provision or on the performance of activities expected to enhance service provision undertaken by the recipient of the fund (Forest Trends et al., 2007).

However, to establish conditionality one must be able to verify the existence of ES, as well as to measure variations in the level of their provision. Ideally, a well-defined baseline should be established in order to allow additional “provided” units to be measured against it (Engel et al., 2008). Nevertheless, in many situations, measuring ES is extremely difficult or prohibitively expensive. In such cases payments may be made through a proxy that is easy to measure and that reflect the level of ES provided (Jack et al., 2008). For instance, while payments are directly made for carbon sequestration (measurable), payments for biodiversity usually include a proxy.

One important consideration in this regard is whether payments must be “performance” or “effort” based (*i.e.* payments for achieving specific results or for the adoption of certain measures, respectively). Performance-based payments are compensations conditional on the outcomes of management changes promoted by the programme. In this case, compensations are made in the basis of the ES provided, as for example payments for water quality, carbon sequestration or sediment load reduction. Although this is the ideal situation, the performance-based approach is not always viable, considering the measurement difficulties explained before. For this reason, most schemes reward the “effort” made by individuals or communities to increase the levels of desired services (*e.g.* adoption of particular land uses). Payments can be area-based (*e.g.* per hectare), or made on

the basis of other inputs, such as number of trees planted or working hours on a specific activity (Gundimeda & Wätzold, 2010).

3.6.3 Type of activity promoted

PES may promote land uses of different nature. According to Wunder (2005), a differentiation can be made between “use-restricting” schemes, which pay for conservation (*e.g.* when farmers set aside an area of forest for conservation), and “asset-building” schemes, which are those promoting restoration of lost ES (*e.g.* reforestation degraded landscapes). Costs tend to be much higher in the second, since it involves changes in land use.

3.6.4 Compliance

In order to ensure that those receiving payments actually comply with the terms of their contracts, a PES programme must include appropriate monitoring and possible sanctions for non-compliance. Most programmes make use of periodical site inspection, however, in large-scale PES remote-sense images are also used. The most common sanction for non-compliance is the loss of future payments, which is particularly difficult to be applied in the case of one-off payments approach (Gundimeda & Wätzold, 2010).

3.6.5 Effectiveness and cost-effectiveness of PES

An important question concerns at which level PES-schemes have been able to achieve their stated objectives. In general, the criteria used to assess the success of PES schemes are (i) *Effectiveness*, meaning the program ability to halt environmental loss or increase the level of desired service provided; and (ii) *Cost-effectiveness*, measured by the program's

ability to achieve targeted ES provision goals at minimum cost (Gundimeda & Wätzold, 2010).

Evaluating the achievements of PES programs is important to ensure that environmental services are been actually provided and that financial resources are not been wasted. However, the evaluation process is complex, especially: when outputs are not easily measured; when the link between proposed management practice and the target service is not completely explained; or because the results from the implemented scheme will come in long term.

The effectiveness and cost-effectiveness of a program is substantially depended on its design features. Following, key points commonly used to assess PES success are discussed, with regards to how they can be addressed at the design stage.

Additionality

The first important concept to evaluate PES efficiency regards how much of the ES provided directly result from the program implementation. In other words, does it really make a difference? Posing this question is important to avoid making payments for nothing, or paying for something that would have happened even in the absence of PES (Wunder, 2005). For instance, paying an Amazonian indigenous community to preserve forests in their land will not have any influence in the level of services provided if this is what they would have done anyway. Thus, PES are considered effective only if payments result in ES provision that would not have happened without the payments.

Additionality is measured against a baseline that represents the expected scenario without PES implementation. The choice of a baseline is extremely important for PES efficiency

and will have an enormous impact on programme evaluation. The three types of baselines most commonly used (Figure 4) were discussed by Wunder (2005): (a) Static baseline, which assumes that ES provision would remain constant over time; (b) Deteriorating baseline, foreseen resource degradation and/or decrease in ES provision over time. In this case any slow-down effect would be qualified as additionality; (c) Improving baseline, represents a situation where loss of natural resources and ES is expected to decrease, even without the implementation of PES.

Leakage

Effectiveness may be weakened if environmental-damaging activities are merely been transferred to areas not included in the PES-scheme, rather than been reduced. For instance, when paying farmers for setting aside forest areas within their lands shifts forest clearing to locations not included in the contract. This problem of leakage may overestimate the environmental benefits generated by PES programs (Engel et al., 2008).

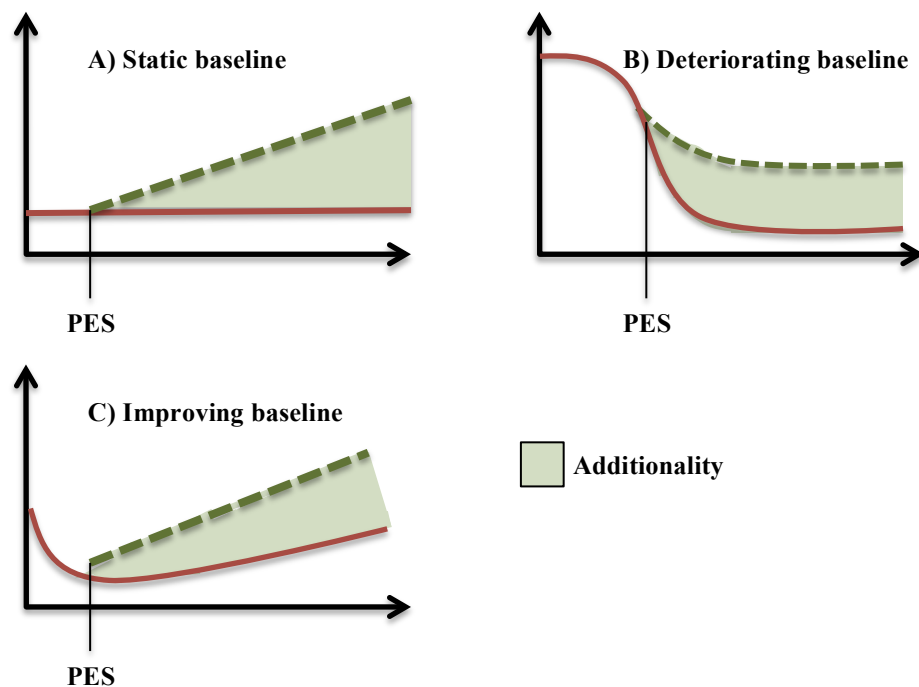


Figure 4. Three different types of baselines (*after* Wunder, 2005).

Permanence

The fact that a PES programme has successfully achieved its stated objectives of ES provision does not ensure that it will be maintain over the long run. The term *permanence* refers to the ability of programs to guarantee long-term provision of ES. As the basic logic of PES is rewarding ES providers for the positive externalities they generate, it is not likely that ES provision will continue in the absence of payments (Engel et al., 2008). Thus, permanence depend on the continued flow of financing – either though government funding (in government-financed schemes) or payments though willing beneficiaries (in user-financed schemes) (Gundimeda & Wätzold, 2010).

In government-financed programs maintaining payments in the long run can be a problem, as it depends on continue budget allocation and is subject to project duration and policy cycles. On the other hand, in user-financed schemes this is less likely to be an issue: as long as users are satisfied by the level of ES provided they will keep paying (Engel et al., 2008; Wunder et al., 2008).

Targeting

It is common that applications of ES providers to enrol a PES programme exceed the available funding resources. In these situations, targeting can be used to select among sites that are expected to increase the program efficiency. Targeting may consider benefits generated, the cost involved or a combination of both (Babcock et al., 1997).

Benefit-targeting bases site selection on higher ES provision or on the level of environmental threat (where threat is high, PES are expected to make greater difference) (Engel et al., 2008). Cost-targeting refers to better allocate the program's budget by taking

into account variations in the costs of ES provision among landowners. The minimum payment required by landowners to join the program (participation cost) includes opportunity, transaction and protection costs, and may vary among sites (Wünscher et al., 2008). Thus, making use of flexible payments to offer applicants a sum equal to (or just above) their particular participation costs allow a greater area to be included in the PES-scheme for a given budget and increase its efficiency (Engel et al., 2008).

Social inefficiency

Considering that PES aim at inducing ecosystem managers to the adoption of privately unprofitable, but socially-desirable, practices by making them more economically attractive, a program is social inefficient when: (i) payments are insufficient and fail to promote adoption of desirable land uses (or to halt undesirable management practices); (ii) payments promote the adoption of actions whose benefits are smaller than their costs (Engel et al., 2008).

Chapter 4

Montado's potential for PES

This section analyses *Montado*'s potential to be on the target of PES-schemes by looking at both the supply and the demand side. In order to identify ES that could be the focus of a PES deal, this chapter speculates the ability of *Montados* to provide the three major groups of ES that have been sold to date: *biodiversity protection*; *watershed services*; and *climate regulation services*. Demand analysis focus on market aspects and drivers of willingness to pay for the three mentioned groups of ES.

4.1 Biodiversity protection

The term biodiversity refer to “variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems” (CBD, 1993). According to FAO (2007) farmers can contribute to protect biodiversity in three different ways: (i) reducing agricultural expansion into biodiversity-rich lands; (ii) adopting agricultural production systems that support the joint production of biodiversity conservation and agricultural products; and (iii) conserving agricultural biodiversity. The two last ways are particular relevant for *Montados*.

Approach (ii) refers to maintaining the wild biodiversity found in agricultural systems. As explained in Chapter 2, *Montados* provide habitats for a variety of species, some of them considered endangered, and the maintenance of such habitats is highly depended on the continuity of traditional land management practices. However, these practices have become economically unsustainable, leading to land use changes and consequent loss of species habitats. Therefore, a degrading baseline can be adopted for *biodiversity protection*, where the expected scenario in the absence of conservation actions is decrease in the provision of this ES.

The term “agricultural biodiversity” mentioned in approach (iii), refer to all the components of biodiversity relevant to food and agriculture. It includes genetic diversity of crops and livestock as well as associated biodiversity that support ecosystem services (*e.g.* pollinators and soil biodiversity) (CBD, 2008). Protecting agricultural biodiversity includes the use of “landraces” (*i.e.* traditional varieties of crops and livestock that have been continuously maintained by farmers within their biological, cultural and socio-economic context), which are often highly adapted to their local environments, and maintaining heterogeneous set of crop varieties in production (FAO, 2007; Veteläinen et al., 2009). The *Montado* is a particular diverse ecosystem whose agro, silvo and pastoral components are traditional from the Iberian Peninsula and highly adapted to Mediterranean climate. Hence, creating economic incentives for sustaining this production system, as well as for the use of landraces, can work for conservation of agricultural biodiversity.

In summary, *Montado* managers can offer to protect species habitat and/or prevent habitat degradation, as well as to enhance agricultural biodiversity. In practice, this would mean charging a fee to the specific set of management practices that are responsible for maintaining both wild and agricultural biodiversity in this ecosystem.

4.1.1 Assessing demand

Proposing payments for *biodiversity protection* is only possible if there is a demand for this ES. In other words, it is necessary to pose the question: who would be willing to pay for maintaining *Montado* biodiversity?

Usually, those interested in increasing the level of a certain ES are those who benefit from it. According to FAO (2007), the benefits arising from biodiversity are attributed to its:

- Direct use value, related to marketed goods or services, such as food items, timber and recreation.
- Indirect use value, which refers to ecological functions underpinned by biodiversity (*e.g.* water recycling, carbon sequestration).
- Optional value, meaning the possibility of future direct or indirect use of biodiversity, or to secure ES in the future (*e.g.* preserving species for potential future uses).
- Non-use values (or existence value), is the importance individuals attribute to biodiversity without deriving any use value of it, purely because of its existence on time and space.

Although biodiversity conservation benefits people locally, nationally and internationally, willingness to pay for it is limited by: i) the public good nature of this service; and ii) the fact that some of the benefits from it will arise in the future and are highly uncertain (FAO, 2007). According to a report released by The Ecosystem Marketplace on The State of Biodiversity Markets (Madsen et al., 2010), there are currently three main drivers of payments for biodiversity: regulatory compliance, government-mediated payments and voluntary markets. Each of them is following analysed.

4.1.1.1 Regulatory compliance

In a regulatory compliance situation, environmental regulations determine a limit or *cap* on the impact to a species or habitat, and then allow markets to be created in order to resolve the cost of offsetting impacts above this limit. Offsetting can consist of ecosystem restoration, rehabilitation or re-establishment, and can take place on-site or off-site (Suvantola, 2005). Willingness to pay for *biodiversity protection* arises when payments for

offsetting represent a low-cost way for compliance with regulations (FAO, 2007). Although offsetting programs do not usually focus on agricultural lands, this can be the case if there is a preference for compensating impacts locally and if agricultural landscapes host significant biodiversity (FAO, 2007), as *Montados* do.

A relevant regulation that could lead to the development of compliance markets is the European-wide Natura2000 Network, established under the Habitats (1992/43/EEC) and Birds (1979/409/EEC) Directives. It aims to maintain and restore Europe's most valuable and threatened habitats and species (EC, 2011a), and includes *Montado* sites. However, regulatory markets for biodiversity are still under development in the EU. In general, environmental regulations do not stimulate demand for compensation actions mainly due to: (i) the limited conditions under which impact is allowed in protected areas; (ii) the strict like-for-like requirements for compensation of the Habitats Directive; and (iii) lack of enforcement of conservation laws at national level (Madsen et al., 2010).

The recent published EU biodiversity strategy for 2020 (EC, 2011b) contain a few points that may help to increase demand for biodiversity compensation actions, such as the full implementation of Habitats and Birds Directives, and the complete establishment of Natura2000 network. It also targets to maintain and restore ecosystem and their services, and to propose by 2015 an initiative to ensure “no net loss” of ecosystems and their services. In this regard, offsetting schemes has been considered a useful instrument to help biodiversity policy.

At national level, the Portuguese Fund for Conservation of Nature and Biodiversity (Decree- Law nº 171/2009) focus on promoting the recognition of the economic value of biodiversity through mechanisms for offsetting certain types of loss, and in developing

market instruments that support biodiversity conservation policies. However, it is difficult to tell when these targets will be translated into effective measures.

As a conclusion, demand for *biodiversity protection* from *Montados* driven by regulatory compliance is not yet an option for PES, but could be in a near future. It will depend, however, on government effort to build the necessary framework for developing biodiversity markets in the region.

4.1.1.2 Government-mediated payments

Government-mediated payments for biodiversity refers to when government (and/or a non-profit organization) acts as a sole “buyer” in order to fulfil public demand for biodiversity goods and services. This can be done by purchasing land or conservation easements, or by creating payment programs for biodiversity stewardship activities. Among the drivers of these types of activity there are: the implementation of national and international environmental protection policies, public pressure, and investing in long-term natural resource supply (Madsen et al., 2010; Forest Trend et al., 2008).

One of the specific objectives of the Portuguese Fund for the Conservation of Nature and Biodiversity is to support the acquisition or lease by public authorities of land under the National System of Classified Areas², or outside them (when land is of great importance for nature conservation). Hence, the fund may represent an important public financial source for biodiversity protection in *Montados*.

Another relevant initiative in the context of government-fund payments for *Montado's*

² Includes Natura2000 sites and the 5 categories of national protected areas (National Park, Natural Park, Natural Reserve, Protected Landscape and Natural Monument).

biodiversity protection services are the Territorial Integrated Interventions (ITIs), a set of measures created by the Rural Development Programme (PRODER) with the aim of promoting agricultural and forest management adequate to biodiversity and landscape conservation. In general, these measures intend to support the continuity and recuperation of those systems threatened by land use change, through financial compensation for conservation or safeguarding of landscapes.

4.1.1.3 Voluntary Markets

Voluntary Markets emerge from a variety of reasons, from ethics and philanthropy to profit and consumption motives. For instance, consumer preference for biodiversity-friendly products may induce companies to invest in biodiversity protection. In a similar way, companies may proactively address environmental issues in order to improve its public image and/or increase investor confidence. Other examples are private donations for biodiversity conservation or research, investments from individuals acting on environmental and social concerns, investments aiming at promoting eco-tourism and recreation, and NGO's acting on environmental mission (Forest Trends et al., 2008; Madsen et al., 2010). All of them are potential sources of demand for biodiversity protection in *Montados*. Particularly, in view of this landscape importance for ecotourism and recreation (see Chapter 2), investments seeking to enhance these activities are likely to be a relevant source of demand for *biodiversity protection* in the region. Consumer's preference is also likely to contribute to the creation of markets for biodiversity, since cork and other outputs from *Montados* can be possibly certified as biodiversity-friendly products.

4.2 Climate Regulation Services

According to The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2007), global warming is unequivocally happening and it is very likely to be caused by human activities that increase concentrations of greenhouse gases (GHG) in the atmosphere. The great majority of the scientific community agree with IPCC's outcomes and fear the severe consequences of climate change to natural systems, as well as to human societies (*e.g.* changes in precipitation rates, severe drought, floods and hurricanes). In view of these threats, and the costs countries will have to face in order to cope with it, climate change has become an issue of global concern.

Basically, there are two ways of mitigating climate change: reducing GHG emission and increasing their storage in terrestrial systems. Agricultural systems can act in both ways. First, reducing emissions from these systems is relevant because agricultural activities, coupled with land use change, represents one-third of the total carbon dioxide emissions, and are the largest sources of methane (from livestock and rice production) and nitrous oxide (mainly from utilization of inorganic fertilizers) (FAO, 2007). Measures for decreasing GHG emission include the use of organic fertilizer, the increase of livestock production per animal unit and improving energetic efficiency in the system (FAO, 2010b). Second, agriculture can contribute to climate regulation by storing GHG, especially carbon dioxide, the most significant gas for global warming. Carbon can be stored both above ground in the form of biomass (*e.g.* by incorporating trees and bushes to farming systems), and below ground, by adopting farming practices that increase soil organic matter content (FAO, 2007; FAO, 2010b).

A significant number of PES schemes that reward the stewardship of agriculture's climate

regulation services - specifically, carbon sequestration and storage - have been implemented around the globe (FAO, 2010b). Indeed, carbon sequestration and storage are considered very important “environmental commodities”, as the markets for GHG reduction emissions currently represent the largest of all ES markets (Forest Trends et al., 2007).

From the two ways agricultural systems can contribute to climate regulation - reducing emissions and storing carbon - only the second might be relevant to *Montados*, as agro-sylvo-pastoral systems based on sustainable management practices are not likely to emit high quantities of GHG. Payments could be developed for carbon sequestration and storage, considering the important role oak trees in this process (see Chapter 2). As *Montados* are currently facing threats of land use change and reduction of forest cover, preventing conversion from a higher to a lower carbon-storing land use would contribute to net carbon storage. Therefore, in view of the degrading baseline for *Montado's* climate regulation services, landowners could offer, for a fee, to keep the traditional management practices that ensure the provision of these services.

However, as mentioned before, the main challenge in establishing PES is to obtain a solid scientific base, or in this case, to assess the amount of carbon ecosystems store. Carbon sequestration rates depend on the tree species, the local climate, the soil type, the topography, and the management practice adopted (FAO, 2007). Previous estimations of carbon sequestration made for *Montados* and for oak forests can give an idea of sequestration rate per hectare. Still, depending on the type of PES implemented and the requirements of buyers, more detailed information might be necessary. Field data collection (in-situ measurements) combined with remote sensing work, can give a better estimation of

sequestration rates, but this can be labor-intensive and expensive (Forest Trends et al., 2008).

4.2.1 Assessing Demand

Climate mitigation services are a prime example of a global public good because while each country faces private costs to reduce GHG emissions, the benefits generated are shared by all unrelatedly to their own efforts (Hasson et al., 2010). Creating markets for public goods is a challenge since it is impossible to link payments to the use of these goods and services (Common & Stagl, 2005). On the other hand, been a public good also means that the location of climate mitigation efforts is irrelevant for its effectiveness, or in other words, the benefits will flow to all equally, regardless of where the mitigation action has taken place. This absence of geographic limitation allows GHG emission reductions to be tradable in a global scale and climate mitigation markets, known as Carbon Markets, have grown big.

4.2.1.1 Understanding Carbon Markets

GHG emission reductions, also referred as carbon credits, are generated through carbon-offset projects. “Carbon offsetting” means to neutralise a certain amount of CO₂ emitted in one place by avoiding its release elsewhere, or by absorbing/sequestering carbon that would have otherwise remained in the atmosphere (Taiyab, 2006). Individuals or organizations interested in neutralizing their GHG emissions can thus purchase emission reductions generated by these projects, which are sold in different existent carbon markets.

Carbon Markets are classified as regulatory or voluntary. Regulatory Markets exist in countries that have set specific “caps”, on the quantity of GHG their industries are allowed

to emit into the atmosphere. If the emission limit is overpassed, a company can purchase GHG offset credits in order to comply with the relevant regulations (Forest Trends et al., 2007). The main drivers of regulatory markets are the “GHG reduction emission targets” stipulated by the Kyoto Protocol³ and the national and regional policies developed to achieve commitments set (FAO, 2007).

The Kyoto Protocol introduced three market-based mechanisms, or “carbon markets”, in order to help countries to meet their emission reduction targets (UNFCCC, n.d.):

- *Emissions Trading* (ET), which allows Annex I countries (*i.e.* those with emission reduction commitments) to trade “emission units” in excess (emissions permitted but not used) to countries that are over their targets.
- *The Clean Development Mechanism* (CDM), which allows trading in emission reductions between Annex I countries and developing countries.
- *Joint Implementation* (JI), which allows trading in emission reductions between Annex I countries

At regional level, the EU has implemented a trade scheme in order to help member countries to meet Kyoto commitments. The European Union Emissions Trading Scheme (EU ETS) is currently the largest regulated carbon market in dollar terms (Forest Trends et al., 2007).

Voluntary carbon markets consist of entities (*i.e.* companies, non-governmental

³ The Kyoto Protocol is an international agreement associated to the United Nations Framework Convention on Climate Change that entered into force in 2005. The Protocol sets binding targets for reducing greenhouse gas (GHG) emissions for 37 industrialized countries and the European community.

organizations, government agencies, international conferences, and individuals) voluntarily buying carbon offsets in order to assume responsibility for their emissions. In this case, motivations are usually other than meeting regulatory targets, as for instance: government agencies, non-profit organizations and companies aiming at demonstrating environmental responsibility; companies using emission reductions as a marketing tool for brand enforcement and loyalty; anticipation of future regulation (preparation to enter regulatory markets); and individuals buying offsets to neutralize their holidays, cars, and domestic activities (Taiyab, 2006). Offset credits sold in the voluntary markets do not necessarily have to pass to the same certification processes than carbon credits aiming the regulatory markets. For this reason, this type of market comprises a broader range of projects (FAO, 2007).

4.2.1.2 *Montados* in the carbon markets

Could *carbon sequestration and storage* in *Montados* be converted in carbon offsets and traded in both types of carbon markets?

In fact, regulatory markets do not represent an opportunity for *Montado* climate mitigation services, for two reasons. First, the mechanisms predicted by the Kyoto protocol restrict emission reductions from “Land Use, Land Use Change and Forestry” (LULUCF) to afforestation and reforestation projects (UNFCCC, n.d.), excluding conservation of existent forest even when the scenario is a degrading baseline. The EU ETS, so far, completely excludes carbon credits generated through the LULUCF sector. Second, even if carbon offset projects implemented in *Montados* include reforestation and afforestation actions, the carbon credits generated would have to be officially certified, for instance as Removal

Units⁴ (RMUs), to enter regulatory markets. This type of certification process requires projects to meet a detailed set of standards, which is complex and costly, and usually end up excluding small-scale programs (FAO, 2007).

Voluntary markets, on the other hand, could be an option. This type of market is much more flexible, as it deals with carbon offsets both from projects that fulfill the requirement of regulatory markets, and from projects that do not. However, carbon offsets that are not certified by the Kyoto Protocol and EU ETS standards must be submitted to other sorts of verification methods in order to build credibility among buyers. There are several types of alternative standards, which are usually less strict than standards from regulatory markets, and may include offsets from a wider range of land-use options that sequester carbon, such as reforestation, conservation, agroforestry, and bioenergy projects (Taiyab, 2006). Carbon credits generated by these alternative processes are known as Verified Emission Reductions (VER).

FAO (2010a) explains that although voluntary carbon markets are smaller than regulatory markets, they might be equally or more significant to farming communities due to the nature of buyers' motivations. Voluntary buyers are more likely to be willing to demonstrate social and economic co-benefits, and public sector can make use of carbon payments to invest in low-income areas and to encourage agroforestry.

As a conclusion, offsets from carbon sequestration and storage in *Montados* could be, in theory, certified through less-strict standards and included in voluntary markets.

⁴ An RMU is defined by the Kyoto Protocol as equivalent to 1 metric ton of CO₂. RMUs are generated in Annex I countries through LULUCF activities that absorb CO₂ (for more, see UNFCCC, n.d.).

4.3 Watershed services

A watershed is the area of land that feeds water to a river by draining precipitation through the landscape into the main river and its tributaries. The quality and quantity of water drained is determined by particular characteristics of the watershed landscape, such as: vegetation cover, topography, geology, soil type, land use and management, as well as other human activities (Smith et al., 2006). Complex interactions between these landscape components result in a variety of natural processes, which are key ES to ensure clean and abundant water supply (*e.g.* water filtration, flow regulation, water supply, and aquatic productivity) (Stanton et al., 2010). To these services provided by ecosystems within a watershed is given the name of Watershed Services (WS).

The health of watershed ecosystems highly influences the provision of WS, hence decisions on management practices taken by upstream landholders are likely to affect water quantity and water quality to downstream users. However, many times landholders have no economic incentive to adopt sustainable management practices that ensure the provision of these services and tend to jeopardize freshwater resources. Indeed, the Millennium Ecosystem Assessment (MA, 2005) highlights that loss of hydrologically important habitats, coupled with water overuse and dropping rates of freshwater recharge, has substantially compromised ecosystems capacity of freshwater provisioning throughout much of the world.

The growing concern over the sustainability of the earth's freshwater resources has giving raise to willingness to pay for watershed conservation and restoration, and for the maintenance of WS. In view of this demand, a promising approach for ensuring water security is the implementation of PES (Stanton et al., 2010). This type of deals represent an

economic opportunity for farmers located in critical areas, who can offer to implement, for a fee, specific natural resource management practices that are expected to provide high-quality and reliable quantities of water. Examples of management practices and benefits targeted are given in Table II.

Table II. Examples of management practices and benefits targeted in PES scheme focusing on watershed services (source: Forest Trends et al., 2008)

Example of management practices	<ul style="list-style-type: none"> • Maintenance/enhancement of forest cover; • Reforestation; • Adoption of ‘sustainable’ or ‘best’ land use management practices (e.g. sustainable farming or sustainable forestry);
Example of benefits target	<ul style="list-style-type: none"> • Creating or maintaining natural filters in the watershed to reduce water pollution; • Maintaining vegetation in order to aid in regulation of water flow through the year; • Minimizing soil loss and sedimentation.

Montado’s forest component plays an important role in promoting infiltration of rainwater and preventing soil erosion (see Chapter 2), which are important WS in the Mediterranean region where water is a scarce resource. Conversion of *Montados* in other land use systems, such as agricultural fields, may threaten the provision of this services, as most of the forest cover of the landscape is likely to disappear. In this regard, *Montados* traditional management practices that ensure sufficient forest cover could be the focus of PES deals targeting WS (more specifically, rainwater infiltration and prevention of soil erosion).

A critical step for developing payments for WS is to understand the link between upstream land management and downstream impacts. Decisions on actions to be supported by payment schemes must be based on substantial scientific knowledge of the relationship between the conditions of ecosystems in a watershed (e.g. vegetation cover; soil use), as well as of its capacity to provide WS. This requires a compilation of the best available and

up-to-date information on location-specific WS, land use, and management practices (Smith et al., 2006). Notwithstanding, lack of a solid scientific base, or the costs arising from it, is a common barrier for the development of such deals.

Previous studies provides evidences of the role played by oak trees (specially cork oak) in water infiltration and soil protection (WWF/CEABN 2008; Branco et al., 2010), but substantial research linking *Montado* land management practices to the actual provision of these services is still missing. Moreover, in order to design a baseline of WS provision it is necessary to understand the consequences of converting *Montados* to other land use systems. For instance, while land intensification and consequent decrease of oak tree cover is likely to increase pressure over freshwater resources, successional vegetation cover appearing after land abandonment can have different impacts.

In summary, *Montados* provide important WS, such as water infiltration and soil erosion protection, but development of PES programs targeting these services would require scientific knowledge that is yet not available.

4.3.1 Assessing demand

Demand for WS arises from the critical day-to-day use value of water and the growing concern with freshwater supplies. Contrary to other ES such as carbon sequestration, these services are primarily interest of local and regional users. For this reason, it is relatively easy to identify users or beneficiaries, who can be stakeholders from both the public and private sectors (FAO, 2007).

Currently, the public sector is responsible for managing most of WS payment schemes around the world (Stanton et al., 2010). In this type of programs, public funds are used to

make direct payments to private landowners for the protection of WS, in order to ensure quality and quantity of water supply for the population.

In Portugal, protection of watersheds is an important issue in view of the threat of desertification to this country, which is likely to increase in response to future changes in climate. The situation is even more critical in the Alentejo region, where *Montado* is the main land use system, because this area combines high aridity with risk of soil erosion (DGOTDU, 2007). In this regard, government-financed PES targeting *Montados* could emerge both in the context of national actions for combating desertification, and local action for ensuring water supply⁵ for Alentejo's population.

Private payments schemes for WS are most of the time developed to solve specific local problems, thus are smaller in scale. In such schemes, buyers are usually private owned companies aiming to protect vital WS, either for business or for philanthropic interests (Stanton et al., 2010). *Montados* are located in watershed that feed urban regions, agriculture and rivers, hence can potentially be the target of payments from downstream beneficiaries willing to increase water quality and/or quantity. In this case, buyers could be other farmers, or companies related to recreation and tourism and from the bottled water sector. As this type of payment schemes are very location-specific, research must be conducted to identify the main beneficiaries from each *Montado* site and assessing their willingness to pay for WS.

⁵Alentejo's public water supply is controlled by a partnership between the National Government and 21 municipalities, which is managed by the company *Águas Públicas do Alentejo, S.A.*

4.4 *Montado*'s potential for PES: Conclusions

Although there are evidences that *Montados* provide all the three types of services analyzed, lack of scientific knowledge and/or market limitation represent a barrier for the development of PES.

Payments for *watershed services* are not likely to work for *Montados*, as the link between management practices and the provision of WS is currently poorly understood. Thus, the present work will not consider PES that focus exclusively on WS as a possible conservation tool for *Montados*.

On the other hand, *biodiversity protection* and *climate regulation* services appear to be a viable alternative. However, “regulatory” markets for these ES are either inexistent or unlikely to be achieved for *Montado* services. Consequently, PES must be restricted to voluntary markets or government-funded schemes.

Chapter 5

Learning from Previous Experiences

PES is a highly variable mechanism, and each type of scheme can be potentially effective and cost-effective in different situations. To successfully implement this instrument, it is important to know how it works in theory, as well as in practice. For this reason, before proposing PES for *Montados*, the previous theoretical analyses have to be complemented with an overview of the practical aspects of this instrument. Analyzing implemented schemes through a case study approach is the way chosen to learn from relevant experiences.

This section collects information on already running PES programs addressing the ES *biodiversity protection* and *carbon sequestration and storage*. The three case studies selected constitute a representative set of PES, which allows seeing at a glance the key features of each mechanism, and will help to assess their potential to *Montados*.

5.1 Methodology

The questions presented bellow were formulated in order to guide case study analysis. By trying to answer them, it is expected that main issues in policy design will be highlighted.

- What type of environmental problem is this program trying to solve?
- What is the aim of the project?
- What are the target ES?
- How does the project work?
- Who are the actors involved?
- What is been paid for?
- How are payments structured?
- How much funding is available?
- How is compliance ensured?
- Project evaluation: what are the positive outcomes and drawbacks?

5.2 Selecting case studies

Case studies selected were those considered relevant for *Montado*'s specific characteristics and market limitations, and with sufficient information available in literature.

For *biodiversity protection*, selection was based on Table III, which contains the main types of payment mechanisms for this service. From the mechanisms listed, those not compatible with *Montado* were excluded, and case studies were searched for the ones left. The goal of proposing PES for *Montado* is to ensure economic sustainability of the traditional management practices responsible for maintaining this system's ecological stability, thus, land is expected to be privately owned and human activities, allowed. Consequently, all schemes focusing on the creation of nature reserves, on land acquisition, or targeting public lands were excluded. Similarly, those schemes based on demand driven by environmental regulation (*i.e.* Tradable Rights under Cap and Trade Regulations) were not considered, as compliance markets for these services are not sufficiently structured in Portugal yet. As a conclusion, case study selection was restricted to the following mechanisms:

a) Payment for Access to Species or Habitat

In this type of schemes private sector's demand for biodiversity takes the form of payments for accessing particular species or habitats (Scherr et al., 2004). For instance, ecotourism companies or individuals paying landowners for the right to observe wildlife, or to hunt and fish in their lands.

b) Payment for Biodiversity-Conserving Management (Management contracts for habitat or species conservation)

This mechanism works by paying landowners to manage their assets so as to achieve

biodiversity or species conservation (Scherr et al., 2004). *Management contracts for habitat or species conservation* are particularly relevant for *Montados*. In such deals, contracts specify management activities that are expected to enhance biodiversity, and payments are related to the achievement of environmental goals.

c) Support to Biodiversity-Conserving Businesses and Production Processes

This type of mechanism relies on the fact that conservation values are beginning to drive consumer's preferences. Most relevant for *Montados* are environmental certification schemes, which advertise or certify that production processes are consistent with biodiversity conservation.

The Biodiversity and Wine Initiative, in South Africa, an environmental certification scheme that also includes ecotourism initiative, was chosen to represent mechanisms *a* and *c*. The Environment Stewardship Scheme, in the United Kingdom, a government-funded scheme where farmers are paid for good environmental stewardship, was selected as an example of mechanism *b*.

For *carbon sequestration and storage*, case study selection focused on voluntary payments for carbon offsets. In this type of deals, different entities, such as companies, NGOs, government agencies, and individuals, voluntarily buy carbon offsets in order to assume responsibility for their emissions. The Scolel Te Project, in Mexico, was the example chosen to represent small-scale forest carbon projects targeting voluntary markets. Programs focusing on regulatory markets were excluded because these markets do not represent an option for *Montado* services yet.

Although in theory types of PES are well discriminated, in practice schemes can combine

several mechanisms. It is also normal that programs target more than one service, or target certain land use practices that are expected to enhance global ES. For these reasons, the case studies chosen include the mechanisms mentioned above and the services selected but are not likely to be exclusive to them.

Table III. Different types of payment mechanisms for biodiversity protection (source: Scherr et al., 2004)

(1) Purchase of High-Value Habitat
<ul style="list-style-type: none"> • Private land acquisition (purchase by private buyers or NGOs for biodiversity conservation) • Public land acquisition (purchase by government agency explicitly for biodiversity conservation)
(2) Payment for Access to Species or Habitat
<ul style="list-style-type: none"> • Bioprospecting rights (rights to collect, test and use genetic material from a designated area) • Research permits (right to collect specimens, take measurements in area) • Hunting, fishing or gathering permits for wild species • Ecotourism* use (rights to enter area, observe wildlife, camp or hike)
(3) Payment for Biodiversity-Conserving Management
<ul style="list-style-type: none"> • Conservation easements (usually in perpetuity and transferable upon sale of the land) • Conservation land lease (for defined period of time) • Conservation concession (public forest agency is paid to maintain a defined area under conservation uses only) • Community concession in public protected areas • Management contracts for habitat or species conservation* on private farms, forests, grazing lands (contract that details biodiversity management activities, and payments linked to the achievement of specified objectives)
(4) Tradable Rights under Cap and Trade Regulations
<ul style="list-style-type: none"> • Tradable wetland mitigation credits • Tradable development rights • Tradable biodiversity credits
(5) Support to Biodiversity-Conserving Businesses and Production Processes
<ul style="list-style-type: none"> • Business shares in enterprises that manage for biodiversity conservation • Biodiversity-friendly products (eco-labeling)* • Niche market development for products with valuable agricultural biodiversity

* Mechanisms considered for case study selection

5.3 Case study Analysis

5.3.1 Biodiversity and Wine Initiative (South Africa)

What type of environmental problem is this program trying to solve?

In South Africa, the best soils for the cultivation of wine grape vineyards are located within the most threatened lowland ecosystems. The Cape Floral Region (CFR) found along the coastline of the southwester part of South Africa is home to the greatest non-tropical concentration of higher plant species in the world. The region is considered a World Heritage site (WWF, n.d.), and a biodiversity hotspot, the only one that comprises an entire floral kingdom (CI, 2007). The CFR is under increasing threat from agriculture, partially because its fertile soil combined with Mediterranean climate creates ideal conditions for viticulture (Fairbanks et al., 2004). Indeed, almost 95% of South Africa's wine-growing occur in this area. As a result, land use changes have increased pressure over the two CFR dominant vegetation groups: Fynbos and Renosterveld (WWF, n.d.).

In view of the fast growing rate of wine industry in this country, there was a call for conservation actions able to control the impacts of vineyards expansion on priority biodiversity areas. The Biodiversity and Wine Initiative (BWI) emerged in this context. When the program was created, in 2004, only 4% of Renosterveld were remaining and most of lowland fynbos were under threat (WWF, n.d.).

What is the aim of the project?

The BWI aim at decreasing loss of threatened habitats as a result of wine industry expansion. For this, the Initiative has two strategies:

- 1) Protecting areas of high conservation value by increasing the total area of natural

habitats included in contractual protected areas.

- 2) Promoting sustainable agricultural practices that enhance biodiversity in vineyards.

What are the target ES?

The main focus of BWI is *biodiversity protection*. However, by promoting sustainable land management practices it also aim to enhance other ES, such as watershed and soil protection, which are crucial for maintaining productive landscapes.

How does the project work?

The project works by accrediting landowners who adopt sustainable farming practices and/or set aside important natural habitats. Participating producers must implement a set of “Biodiversity Guidelines” developed by the BWI in order to be audited and certified by the industry's Integrated Production of Wine Scheme (IPW). Although these guidelines address the whole range of cultivation aspects (*e.g.* selection of cultivars, vineyard layout, irrigation, integrated pest management and pruning), they are intended to be practical and realistic for farmers (WWF, n.d; SANBI, 2007).

Producers can enroll the program in two different levels: as BWI Members or BWI Champions. While BWI Membership is the entry level into formal collaboration with the Biodiversity & Wine Initiative, BWI Champions are exceptional producers who earn additional recognition for their outstanding environmental responsibility. Members and Champions are then able to market their wines as associated with the BWI. Wines of South Africa (WOSA), an organization that promotes exportation of South African wine, is responsible for marketing the scheme.

The BWI also encourage producers to promote ecotourism in their vineyards by associating

wine routes to the rich biodiversity of the region.

Who are the actors involved?

The BWI was initiated in 2004 through a partnership between the wine industry, the Botanic Society of South Africa, Conservation International, and The Green Trust (a partnership between Nedbank and WWF). These institutions are important intermediaries, providing all the necessary technical and economic support. Funding currently comes from The Green Trust (a partnership between Nedbank and WWF), the RMB Fund, Mazda Wildlife and Wines of South Africa (WOSA).

The sellers involved are wine producers from the Cape region that commit to adopt specified land use practices that are expected to enhance biodiversity and promote sustainable land management. To join the program, wine producers must have on their farms at least two hectares of natural vegetation, or pristine water resources.

The buyers are national or international wine consumers who purchase wine from producers committed with the BWI, and indirectly help to finance sustainable land management and provision of ES. Other types of buyers are companies and individuals paying to undertake ecotourism activities in certified vineyards.

What is been paid for?

When purchasing certified wine, consumers are not directly paying for ES provision, but are generating incentives for landholder's effort in adopting practices that are likely to enhance ES provision. In other words, payments are effort-based.

In the case of ecotourism activities, payments are made for the right to observe wildlife and enjoy landscape aesthetics, thus, payments are directly connected with ES provision.

How are payments structured?

This is an example of PES program where no direct in cash payments are made for ES providers. Instead, financial compensation relies on the marketing benefits generated by the program, which are expected to increase representativeness of certified wines in the global markets and to enhance wine ecotourism (biodiversity wine routes).

However, the BWI assists producers with non-monetary support such as:

- Helping farmers to assess the conservation value of their land and to identifying important habitats to be “set aside” as protected areas.
- Substantial support in understanding and implementing the Biodiversity Guidelines in each specific farm's context, including development of farm-specific management plans.
- Identifying unique marketing elements – from rare species to magnificent scenic routes and trails.
- Media exposure and free marketing by featuring conservation stories on the BWI website, tourism magazines, and regular media exposure that the project receives.

How much funding is available?

No information about funding amount was found.

How is compliance ensured?

BWI membership in both member and champion level is valid for two years. After this period a new audit must be conducted and producers must submit required documents (*e.g.* valid IPW certificate, farm map, allocated conservation budget). Membership can be suspended as a consequence of:

- Failed IPW audit;
- Illegal transgressions;

- Failure to implement agreed upon farm management plan on schedule

Project evaluation: what are the positive outcomes and drawbacks?

According to the BWI official website (WWF, n.d.), more than 126 000 hectares of natural vegetation in the CFR has been conserved since the beginning of the program. This figure well exceed the current vineyard footprint of the Cape wine lands, estimated in 102 000 hectare, which means that there is a hectare of conserved natural vegetation for every hectare of planted vine. Therefore, the BWI appears to be achieving its environmental objectives.

However, as reviewed in Chapter 3, when assessing the success of a PES scheme not only environmental indicators must be taken into account, but also concepts such as additionality, leakage and permanence, as well as the social costs generated by the program. Unfortunately, to date, very few authors have tried to substantially assess the BWI performance. A relevant publication available in this regard is the work of Bridgman (2009), entitled “Biodiversity and the South African Wine Sector – A Successful Blend?”.

The Biodiversity & Wine Initiative BWI currently has 162 Members and 21 Champions and, as producer’s inclusion is totally voluntary, these figures suggest that getting involved is worthy from an economic point of view. Additionality is suggested as several farmers have adopted sustainable management practices and a large area was set aside for conservation, which is not likely to have happened in the absence of the program.

Nevertheless, Bridgman (2009) interviewed BWI members who declared they have seen no increase in sales since joining the program. Some of them said they promote conservation by self-motivation rather than due to economic incentives. If this is truly the case and

conservation efforts would have happen anyway, the program's additionality has to be questioned.

Farmers also declared they do not think biodiversity makes an effective marketing message or help to sell wine. Some producers say they would prefer tax reductions or other forms of compensation for their conservation efforts. Indeed, selling the "biodiversity message" is not an easy task, especially because consumers understanding may vary according to location. As highlighted by Bridgman (2009), it is not likely that people outside South Africa are aware of the ecological importance of Fynbos and Renosterveld. Yet, there are examples of successful history of producers who increased sales by associating their brands with particular species found in their terrains, such as daisies, ladybirds and chameleons.

No information was found about the income generated by ecotourism activities promoted by the Initiative. However, several offers of tour packages involving wine routes in BWI member estates were found online.

One important issue threatening the sustainability of the BWI in the long run is funding. The program is not self-sustainable, does not have incentives from the government, and financial returns from increases in sales is not materializing as expected - which is also frustrating participants. Bridgman (2009) investigated two BWI Champions and found out that conservation actions are not supported by wine sales, but by other economic activities undertaken by estate's owners or investors. For instance, one of the properties studied is owned by a group of global companies involved in the mining and natural resources sector. Ironically, in this case funding for conservation comes primarily from environment-destructive activities.

Following Bridgman (2009) conclusions, markets do not yet offer enough support to

biodiversity-friendly wine, or in other words, it appears that there are not enough wine consumers for whom conservation of the CFR matters. However, markets for environment-friendly products are expanding fast and programs can be re-designed from learning by doing. The main challenges involved are to effectively transmit the “biodiversity message” (*i.e.* make farmers, consumers and all stakeholders involved understand the value of biodiversity) and to find reliable sources of funding.

5.3.2 Environment Stewardship Scheme (England)

What type of environmental problem is this program trying to solve?

A major transformation in agriculture was observed in the United Kingdom (UK) in the past century. After having its agricultural productivity and food supplies threatened by the country’s involvement in the World Wars, the UK government started a massive effort to intensify agriculture and increase food production (Dobbs & Pretty, 2004). Policies implemented to modern agriculture were based on several types of subsidies and grants for specific management practices (Pretty, 1998).

These efforts, coupled with further support from the European Common Agricultural Policy (CAP), were successful in promoting modern agriculture and increasing provision of food and fiber, but at high environmental costs (Pretty et al., 2000). This is because the spread of simplified modernized systems focusing only on the provision of commodities reduces biodiversity and decreases the provision of several ES. As a result intensive agriculture externalize costs that others in society must bear (Dobbs & Pretty, 2004).

Contrarily, sustainable agriculture based on diverse multifunctional systems can deliver valuable ES (Dobbs & Pretty, 2004). The challenge is to develop policies that incentive

sustainable agriculture, as most of the benefits generated by this land use are positive externalities from a farmer's point of view.

The UK was the first European country to reform its agricultural policy in order to resolve environmental problems emerging from modern, intensive agriculture (*i.e.* implementation of the Environmentally Sensitive Areas scheme, in 1986). The Countryside Stewardship Scheme was a major program launched in England in 1991 aiming to promote sustainable land use through land management contracts (Dobbs & Pretty, 2008). The program recently (2005) evolved to the Environment Stewardship scheme (ESS), which is here analyzed⁶.

What is the aim of the project?

This is a multi-objective scheme created in order to conserve, enhance and promote the England's countryside. Its primary objectives are: conserving wild biodiversity; maintaining landscape quality and traditional character; protecting the historic environment and promotion of public access and understanding; and protecting natural resources (water and soils). As secondary objectives it comprises genetic conservation (conservation of landraces), flood management, and adaptation to climate change.

What are the target ES?

Primarily, *biodiversity protection, watershed and soil protection, and cultural services*, such as recreation and landscape aesthetics. Secondarily, *agricultural biodiversity protection, flood control and climate regulation*.

How does the project work?

The ESS financially reward and offer advice to farmers for good environmental

⁶ The following analysis is based on information from Natural England (2011).

stewardship of their lands. Interested farmers may apply for one of the four environmental stewardship categories available, according to the specific characteristics of their lands and their level of commitment to environmental conservation. The options are:

- Entry Level Stewardship (ELS), which is opened to all farmers and provides them with a straightforward approach to delivering simple and effective environmental management.
- Uplands Entry Level Stewardship (UELS), specific for farmers in England's "Severely Disadvantaged Areas".
- Organic Entry Level Stewardship (OELS), specific to organic and organic/conventional mixed farming systems.
- Higher Level Stewardship (HLS), a targeted and competitive type of agreement, only available to farmers in priority areas. It is based in more complex types of management with an emphasis on conservation, restoration and creation of habitats. It aims at delivering significant environmental benefits over a longer period of time.

In general, acceptance is determined by a calculation of points per hectare across the property. Several management options are available (*e.g.* hedgerow management, providing wild bird cover and creating buffer strips) and each of them corresponds to a certain number of points. Farmers must select practices to be undertaken over the course of their contracts. They must achieve a total of 30 points per hectare for the *Entry Level*, and 60 for the *Organic Entry Level*. A wide range of advice and training is available to help land managers to sign up or renew agreements. Farmers receiving payments from other agri-environment schemes are only able to apply for ESS on other land that is not receiving this type of direct funding.

Who are the actors involved?

The ESS is part of the Rural Development Program for England (RDPE) 2007-2013, which is funded by the English government and EU. Therefore, this is a government-financed PES scheme where the major buyers, the English government and EU, pay for ES provision on behalf of all the citizens who benefit from it.

The sellers are English farmers, land managers or tenants, who voluntarily join the program and receive payments for undertaking specified management practices.

The main intermediary is the Natural England, a non-departmental public body that administrates the program on behalf of the Department for Environment, Food and Rural Affairs (DEFRA).

What is been paid for?

Payments are made for management practices specified in Stewardship contracts, which are supposed to enhance the program's target ES. Therefore, payments are effort-based.

How are payments structured?

Agreements under the ESS last for 5 years, except the HLS option, which last for 10 years. For the ESL and OESL payments are a fixed amount of £30 ha⁻¹ yr⁻¹, and £60 ha⁻¹ yr⁻¹, respectively. Farmers start to receive funding as soon as they achieve the required points and meet the scheme conditions.

For the HLS, payments are not based on the same point system. Instead, financial reward for each management practice is specified in a list and the total payments will depend on the number of options farmers are able to deliver. For instance, a hectare of enhanced wild birdseeds mix plots worth £475. There are also payments available for capital works, such

as hedging, pond creation or historic building restoration, which can be claimed at any time.

How much funding is available?

The RDPE has available £2.9 billion (approximately €3.3 billion) of funding to support sustainable agriculture throughout the countryside.

How is compliance ensured?

The Rural Payments Agency visits a percentage of agreements annually in order to assess compliance with the ESS requirements. Penalties for those who have failed to keep the terms of their contracts can be: withheld of part or all of future payments; recover of part or all payments already made (and interest charged); end of the agreement; or farmer is prohibited from entering into a new agreement under any EU agri-environment scheme for up to 2 years. (For more information see: Natural England, 2010)

Project evaluation: what are the positive outcomes and drawbacks?

Currently, there are about 43 000 Environmental Stewardship agreements, which cover an area of 5.5 million hectares. If predecessor scheme agreements that still in force (e.g. the Countryside Stewardship Scheme) are taken into account, this area increases to approximately 700 000 hectares. Indeed, nearly 70% of England's farmland is under some type of agri-environment schemes (DEFRA, 2011).

Despite the lack of long-term monitoring, there are evidences of environmental benefits from agri-environmental schemes (AES) in England. The large area and the several management options comprised by the ESS are expected to deliver significant benefits to biodiversity, particularly in regard to vegetation and birdlife in habitat such as: arable,

species-rich grasslands, hedgerows, moorland and lowland heaths, and some types of wetland (Boatman et al., 2008). The ESS is also expected to make substantial contributions to water and soil protection, climate regulation, and to the provision of several other ES (Land Use Consultants & GHK Consulting Ltd., 2009).

Targeting plays an important role in AES. Schemes that identify environmental features that need to be protected and then introduce appropriate management may be more successful than generic schemes (Boatman, 2008). Under the ESS, both ELS and HLS options can make important contributions to ES delivery, but it is clear that HLS option delivers a broader range of ES (Land Use Consultants & GHK Consulting Ltd., 2009). This type of agreement is highly competitive and targeted at where it can bring maximum benefit. As the ELS option also rewards the maintenance of current sustainable practice, in many cases little change in management is required to settle an agreement. Thus, although maintaining such practices is beneficial and relevant at the landscape level, ELS agreements will not necessarily generates improvements in environmental conditions (Boatman, 2008).

One of the drawbacks of the ESS was highlighted by Fraser (2007), and regards payment design. The amount of payment for farmers is calculated based on the average income forgone of agricultures to change their management practices, rather than on society's willingness-to-pay for the ES generated. According to the author, in this case, ES provision is expected to be under the social desired level in some regions, and over it in others. In other words, this design choice may lead to misallocation of service provision within and among regions.

5.3.3 Scolel Te Project (Mexico)

What type of environmental problem is this program trying to solve?

The Chiapas region, in southern Mexico is an ecological and cultural important area, which houses several indigenous communities (Plan Vivo, 2009). Over the past 20 years, increase in human activities such as timber extraction, charcoal burning and conversion of forested areas in crops and pasture has threatened the region's natural resources. Ecosystem transformations have generated problems both at local and global scale. While land degradation and scarcity of forest products affected the livelihood of thousand indigenous people living in the region, deforestation increased carbon emissions contributing to climate change (Tipper, 2011).

In 1996, the Scolel Te program was created to tackle both problems by using PES as its main policy tool.

What is the aim of the project?

This is a community-based sustainable land use project. It aims to reduce carbon emissions and restore carbon sinks through activities such as: afforestation and reforestation; agroforestry; forest restoration; and avoided deforestation.

As co-benefits, the program promotes biodiversity protection and poverty reduction.

What are the target ES?

The ES considered are *carbon sequestration and storage; biodiversity protection; soil fertility; and water quality* (Morrison, 2010).

Who are the actors involved?

This is a user-financed project where the buyers are private companies or individuals who purchased carbon credits generated by the program in order to compensate their own emissions. Examples are Formula One, World Rally, Future Forests and the World Bank (Forest Carbon Portal, n.d.).

The sellers are small-scale farmers, forest dwellers and other land users with recognized land rights, who voluntarily join the project through community structures, such as cooperatives, associations and organizations.

The main intermediaries are the Fondo Bioclimático (a non-profit trust fund), which administrate the program, and the Mexican NGO AMBIO, the coordinating institution. The Scolel Te project was designed by the Edinburgh Centre of Carbon Management, in partnership with AMBIO, El Colegio de la Frontera Sur and the University of Edinburgh (UK).

The Plan Vivo foundation, a registered Scottish charity, is responsible for developing and overseen the Plan Vivo Standard and System (*i.e.* a framework for community-based, sustainable land use projects in developing countries), which is the standard used in this project. Besides facilitating the development management plans, the Foundation reviews and registers projects, issues Plan Vivo Certificates, and deals with third-party verifiers and resellers of Plan Vivo Certificates.

How does the project work?

Producers create sustainable land management plans (*plans vivos*) following the Plan Vivo Standard (see www.planvivo.org). They must describe the type of systems they wish to implement, its location, the predicted changes in current vegetation and practices, and the

necessary labor and material. In this planning phase, farmers receive training and support to ensure that their *plans vivos* include relevant information, that the type of forestry system proposed is feasible, beneficial and sustainable in the long run (Tipper, 2002). *Plans vivos* are expected to combine existing land uses with other activities such as the creation, restoration and protection of native forests, as well as agroforestry initiatives that improve crop productivity, soil quality and protect watersheds (Plan Vivo, 2009).

The Plan Vivo Foundation issues tradable certificates and deals with carbon credits verification and selling. Note that, although *plan vivos* target “bundled ecosystem services”, payments and monitoring are based on carbon credits (Morrison, 2010).

What is been paid for?

As buyers are interested in purchasing carbon credits, payments are made according to the amount of carbon generated by each producer.

The amount of carbon stored in plan vivo project can be estimated thanks to a range of methodologies developed by technicians together with local institutions and external consultants. They consist on guidelines for specifying the carbon potential of each land use system and associated management, based on a simple carbon accounting model. For this, these methodologies include baseline studies, biomass surveys, carbon modeling, and assessments of biodiversity and socioeconomic impacts.

Credits are traded in the form of *Plan Vivo Certificates*. Each certificate corresponds to a ton of CO₂, but also represents a variety of environmental and social co-benefits generated by the practices undertaken (Plan Vivo, 2009). The price of a ton of carbon (tC) has ranged between US\$ 10-18 (Forest Carbon Portal, n.d.). Plan Vivo Certificates are ex-ante carbon

credits, meaning that they are based on future expected carbon accumulated rather than on measured emission reductions.

The Plan Vivo Carbon Monitoring Systems is periodically reviewed by the SmartWood, an independent certification arm of Rainforest Alliance.

How are payments structured?

In order to meet supply with demand, de Scolel Te project created a framework that predicts implementation of sales in two ways: Actual transactions (direct sales) and forward agreements (based on a reserve fund).

The first option is applicable when companies are willing to pay for carbon credits, and the AMBIO intermediates carbon sales by discussing the conditions and steps with the parties involved. The second option regards situations where producers want to carry out reforestation activities in the absence of carbon buyers. In this case, carbon credits are registered in a Reserve Fund from where they can be purchased by future buyers, or by the Fondo Bioclimático for contingency purposes (AMBIO 2006).

Part of the payments is deducted for covering the costs of the program. According to the Scolel Te Program Plan Vivo Annual Report 2010 only 24% of payments were actually transferred to producers in that year.

How much funding is available?

The project started as a research project funded by the UK Department for International Development (DFID), and also received investments from the FIA Foundation, and the Mexican Instituto Nacional de Ecología. Information regarding the amount of funding was not available.

Since 2002, the program has operated on an entirely self-sufficient basis (Plan Vivo, 2009; Forest Carbon Portal, n.d.).

How is compliance ensured?

Certificates are issued annually, after projects are submitted to a monitoring/review/improvement cycle. Projects must present annual reports and database to the Plan Vivo Foundation for review and approval. If the Foundation standards are not met, approval may be qualified by the imposition of corrective measures. Besides, within 5 years of registration, projects are required to undergo through third-party verification by a Plan Vivo approved verifier.

Project evaluation: what are the positive outcomes and drawbacks?

After 15 years of existence the Scolel Te Project shows strong signs of success. It currently covers an area of 9 645 hectares, and has 1 083 *plans vivos* registered from 2 437 producers. Until the year of 2010, a total of 432 166 t CO₂ were sold as Plan Vivo Certificates (Montalvo et al., 2011). However, the most relevant contribution of this project was the establishment of a framework (the Plan Vivo System) to include small farmers from developing countries in the carbon markets, which can serve as a starting point for many similar projects. It is also notable that the program has been running in a self-sufficient base for more than eight years, a sign that the target ES has been provided at societal desired levels (*i.e.* supply is meeting demand).

One of the key points of the observed success is the fact that issues of *additionality*, *leakage* and *permanence* are carefully addressed in the planning process of each project proposed. Additionality is a pre-requisite for the establishment of a project, meaning that

farmers must prove that proposed projects: i) do not owe their existence to legislation or commercial land use initiatives; ii) are not likely to be economically viable without the PES approach; iii) would be prevented from happening in the absence of carbon finance, due to economic, social, or technical barriers (Plan Vivo, 2009).

Leakage is avoided by designing project's activities in a way that communities can meet their resource needs within the boundaries of the projects. Moreover, in regard to afforestation and reforestation activities, it is compulsory for producers to have sufficient land for both agriculture and forest, in order to prevent agricultural displacement and forest clearing elsewhere. Permanence is ensured by careful initial assessment of projects long-term viability combined with specific measures, such as: participatory planning and management, secure land rights, transparency, long-term agreements (Plan Vivo, 2009).

5.4 Conclusions from Chapter 5: lessons learned from case studies

The Biodiversity and Wine Initiative (Environmental Certification scheme)

- A program can be an attractive opportunity for farmers and effectively achieve its environmental objectives even in the absence of direct in cash payments.
- Environmental certification is highly dependent on technical support from intermediaries. A first crucial step is the development of guidelines after detailed study of the positive and negative impacts of each management practice, as well as studies to identify priority areas for conservation. Moreover, technical support must be constantly available to help landholders complying with certification requirements.
- Although consumer's preference for green-products is a global trend, using biodiversity to help increasing sales may not always be a successful strategy. Even for a product with a strong market (wine), expected increase in sales has not materialized. It seems that biodiversity does not make an effective marketing message yet; at least not in the way the BWI is communicating it.

- Transparency and stakeholders involvement is important for a program's sustainability. A high number of members does not necessarily mean that farmers are satisfied and will continue in the program. Farmer's participation can decrease if they get frustrated because expected increase in sales is not happening, and if they do not really understand the importance of the conservation actions undertaken.
- Ecotourism can be implemented as a complementary activity of environmental certification schemes.
- The two main challenges in maintaining certification program in the long run are:
 - Finding reliable sources of funding. It is common that projects are not self-sustainable at initial stages. When government incentives are not available, investments from private companies or institutions are necessary to cover the costs of the project.
 - Successful translating environment-friendly production process in a strong marketing message. This is crucial for increasing sales and monetarily reward sustainable management practices.

The Environmental Stewardship Scheme (Payments for Environmental Stewardship)

- Agri-environmental schemes (AES) in the modes of the ESS can be a useful tool for environmental conservation in agricultural landscapes. However, they depend on high government financial support, and may not be applicable in less strong economies. Moreover, as in this case permanence is conditional on government budget allocation, AES could not survive times of recession, when national priorities are other than environmental issues.
- To be successful, AES may rely on a detailed identification of land management practices and their respective impacts on the environment.
- Intermediaries play an important role by carrying on necessary scientific research, coordinating and monitoring the project, as well as providing technical support and advice for farmers willing to get involved.
- The amount of payments must be calculated in a way to reflect the societal desired level of target ES. Although estimations based on the average opportunity cost are a

common approach, it does not reflect people's willingness to pay for ES, which can mismatch supply and demand (i.e. provision over or under desired levels).

- Targeting is a key issue underpinning the success of AES in regard to ES provision. Creation of different levels for enrolment can be a useful tool to increase farmer's participation, but outcomes from each level may not be the same.
 - Less strict levels that allow farmers to select, within a range, the management practices they want to implement will certainly attract more applicants. Therefore, this approach is likely to cover a greater area and be relevant at landscape level. However, additionality may not be very high, as farmers tend to select practices already under use, or those that do not require much change in their production way.
 - More targeted and competitive levels of enrolment that focus on priority areas or features are more efficient in increasing ES provision, however they are less accessible to farmers.

The Scolel Te Project (Small-scale forest carbon project)

- PES programs focusing on *carbon sequestration and storage* can be applied for small landholders and deliver substantial environmental results.
- There is demand from voluntary markets for carbon credits certified by alternative systems rather than those stipulated by the Kyoto Protocol.
- Developing alternative carbon certification systems is a way to tailor projects to particular environmental contexts. When specific conservation targets are incorporated in a program's standard, carbon credits represent more than carbon stored or sequestered as biomass, but correspond to all the environmental and social benefits generated by the actions implemented.
- Projects can operate in a financial self-sufficient basis, even if intensive technical support is necessary. Part of the income from carbon sales can be allocated to cover costs.
- Intensive scientific research is needed to set up a carbon project, which can be time-consuming and costly. It is necessary to estimate the amount of carbon stored/sequester, both below and above ground, by the different land uses to be

adopted in the program. However, many times the methodology for this calculation is not yet available and has to be developed by those starting the project. Estimating carbon sequestration is a difficult task that requires not only ecological data but also socio economic studies to predict land use changes.

- Besides initial funding, the realization of a carbon project requires scientific support to estimate carbon potentials and to design land management plans consistent with ES provision.
- Addressing additionality, leakage and permanence during the developing stage of each management plan substantially contributes to project success. Supporting participation of local communities through workshops and training programs can also increase efficiency.

Chapter 6

Results: Proposing PES for *Montados*

The main goal of the present work is to propose PES as a conservation tool for *Montados*. For this, it started with a consistent analysis of the target ecosystem and the instrument selected (Chapter 2 and 3, respectively), followed by an overview of *Montado's* ability to supply, in the modes of a PES scheme, the three major groups of ES sold to date: Biodiversity Protection, Climate Regulation and Watershed Services (Chapter 4). The demand side for these services was also assessed, and it was concluded that *Montados* could be potentially included in schemes focusing on *biodiversity protection* and climate regulation services (*carbon sequestration and storage*), but only outside regulatory markets. The next step was to search in the literature payment mechanisms suitable for *Montados* and, through a case study approach, learn from already-running PES schemes. The mechanisms selected⁷ for *biodiversity protection* and the respective case studies were: Environmental Certification, represented by The Biodiversity and Wine Initiative (South Africa); and Payments for Environmental Stewardship (under Agri-environmental Schemes), represented by The Environmental Stewardship Scheme (United Kingdom). For *carbon sequestration and storage*, The Scolel Te Project (Mexico) was chosen to represent small-scale forest carbon project targeting voluntary markets.

This chapter analyses the suitability of the instruments selected to *Montados*, thus, it represents the final step of the work. This is done based on all the information reviewed through this document and on complementary literature review. This section also aims to elucidate the main challenges emerging from the implementation of these tools in order to provide guidance and advice to policymakers and project developers.

⁷ In view of the lack of information about “ecotourism” in the BWI case study, this mechanism was excluded from further analysis.

6.1 Environmental Certification (Biodiversity-friendly products)

Environmental certification (or eco-labelling) is a market tool used to support production processes consistent with environmental conservation. The idea behind this instrument is that consumers would prefer environmental-friendly products, or even be willing to pay a “green premium” in addition to their market price. Certification is usually advertised in the form of *eco-labels*, which tell consumers that products have achieved specific standards of environmental quality. As *Montado* management practices are consistent with biodiversity conservation, environmental certification focusing on *biodiversity protection* could be applied to these system’s outputs. In theory, increasing the market appeal of *Montado* products, or adding a “green premium” to it, would generate financial incentives for farmers to maintain sustainable land uses. Cork would be the target product, as this is the only output whose markets are strong enough to be worth certification. In general, holm oak *Montados* produce no market products competitive enough to enter certification schemes.

However, careful is needed when applying this instrument to *Montados*. As stated before, this ecosystem is under economic stress because of its extreme resilience on cork, whose markets are facing instability due to competition with synthetically materials. While environmental certification could enhance cork’s competitiveness, it does not seem wise to increase the value (*i.e.* add a green premium) of a product that is facing market instability. Furthermore, the BWI case study shows that transforming environmental conservation into a successful marketing message is not an easy task, even if markets for green products are expanding fast. Following, the most relevant issues regarding the implementation of this mechanism to *Montados* are discussed.

Costs and funding

Montado farmers are not expected to face high costs in order to comply with certification guidelines, as most of their management practices are consistent with biodiversity conservation, and cork harvesting is a low impact activity. However, there are several other costs that may arise from a certification process. Management practices must be documented, and their link with biodiversity protection identified, which requires technical and scientific specialists. In addition, each property has to be verified both at the implementing stage and periodically for monitoring. If farmers are expected to bear these costs alone, it is very likely that they will not consider the program an attractive opportunity. For this reason, external funding would be necessary, at least at the design and implementation stages.

The BWI is funded by a bank, an insurance company, NGOs, and by the wine industry organization. The first challenge of implementing a similar program in *Montados* is to find institutions, government agencies or private investors willing to cooperate. Ideally, the program should become self-sufficient in the long run, but this is only possible if the increase in sales is high enough and part of the revenues can be allocated to cover project costs.

Institutional set up and technical support

Usually certification is conducted by a NGO, which has the roles of documenting management practices, elaborating guidelines and offering technical support to farmers, issuing certificates, and monitoring compliance. When the certifying institution lack of technical and scientific information, hiring out specialists can help to reduce the costs of training people and obtaining technical resources. Sometimes, research institutes may be

willing to cooperate with baseline information for free through their research projects (FAO 2010a).

The BWI relies on the WWF-South Africa as central coordinating institution. As for other PES schemes, the enduring participation of an institution pushing the entire process, and specially, making continuous adjustments, is of great advantage. Drawing on existing capacity of reliable institutions, with a solid management competence and awarded recognition from stakeholders, can help keep costs low and reduce initial hesitation about the reliability of an completely new institution. However, many times an institution in this modes is absent, and the central intermediary takes the form of a committee formed be representatives of the different sectors involved, such as: user associations, producers cooperatives, government bodies and NGOs (FAO, 2010a).

Assessing demand and marketing biodiversity

Two important lessons in the context of biodiversity markets were learned from the South African experience. First, even if in theory the demand for environment-friendly products is growing, in practices environmental conservation is not yet a strong driver of consumer's preference for certain products. For instance, people may base their wine choices in other criteria than ecological sustainability, such as quality and price. Second, even if consumers are worried about environmental conservation, their purchasing decisions will only be driven by conservation actions they are able to understand, and this ability may vary according to location. An example is the fact that people outside South Africa are not likely to recognize the importance of conserving Fynbos and Renosterveld. In a similar way, it is not likely that people outside the Iberian Peninsula recognize the conservation value of *Montados*.

As a conclusion, environmental certification schemes in *Montados* will only be effective and sustainable in the long-run if: i) the demand for biodiversity-friendly cork is high enough to generate increase in sales; and ii) biodiversity protection is translated into a strong, understandable, marketing message.

Complementary activities

The BWI encourage its member to promote wine tourism in their estates by associating it with biodiversity. Although no reliable data was found about the profitability of this activity, the number of wine “eco-routes” advertised online, specially on the BWI website, tells a promising history. In a similar way, ecotourism could be promoted in certified *Montado* properties to complement the revenues from cork sales. This ecosystem is already chosen by tourists who want to appreciate landscape beauty, to rest, and to get in touch with the regional traditions and typical gastronomy. Associating *Montados* with biodiversity could help to increase the potential of rural tourism in the region.

What has already been done in this context?

Certification of *Montado* outputs has already started. The WWF and the Mediterranean Forests Union (UNAC) recently joined forces to implement a certification program that aim to cover 150 thousands hectares of *Montados* (20% of cork oak forest cover in Portugal) (UNAC, 2008). Certification is done through the Forest Stewardship Council, an international NGO that has created a labeling system for forest management practices.

About 10 000 ha of *Montados* have already been certified in the region of Coruche. Following auditing advice, producers also decided to set aside 5% of the total area fully protected for conservation purposes. About 825 t yr⁻¹ of cork are sold for a premium of 0.5€

over the same non-certified product. Together with 4 300 m³ yr⁻¹ of certified eucalyptus timber, it corresponds to an annual turn over of 1.5M€ (FSC, n.d.).

Conclusion: Environmental Certification in Montados

Environmental certification can increase the profitability of *Montado* management practices, as shown by the initiative described above. Nevertheless its application must not be considered an ultimate solution, as it is limited to areas where cork sales are strong. Furthermore, the sustainability of certification schemes might be threatened by the instability of cork markets, as financial rewards from this mechanism are totally depended on sales. For this reason, it is recommended that before designing a certification program for *Montados*, one must be sure that the demand for certified cork is high enough to make the program be worth it.

6.2 Payments for Environmental Stewardship (Agri-environmental Schemes);

Agri-environmental schemes (AES) reward farmers for adopting sustainable land management practices. For several authors they are considered the most important and only realistic policy instrument to halt biodiversity loss in Europe (Donald & Evans, 2006; Warren et al., 2008). *Montados* are biodiversity-rich private-owned land, whose ecological stability is highly depended on human management. Therefore, stewardship payments that reward practices responsible for maintaining biodiversity could help conserving these landscapes.

There are several advantages in applying this policy tool to *Montados*. First, stewardship payments under AES are compatible with the limitations in demand for *biodiversity protection*. As explained in Chapter 4, compliance markets for *Montado biodiversity*

protection services are not well structured yet. Demand, in this case, may only emerge from voluntary or government-funded payments. AES are included in the second category, where the government pay landholders for ES provision on behalf of society. Relying on government payments simplifies the structure of a scheme and decreases transaction costs, as it is not necessary to be constantly searching for buyers. Furthermore, while user-financed programs are, in general, more efficient in solving local environmental problems, a project in the modes of AES can be more efficient in promoting conservation at the landscape level. Government-funded projects are likely to be larger in scale, involving a higher number of farmers, and covering a greater area. A project that promotes landscape connectivity is particularly relevant for biodiversity conservation, as it allows higher levels of species dispersal and may result in more sustainable meta-populations (Merckx et al., 2009).

Another advantage of applying AES to *Montados* is that this instrument is relatively simple for landholders to understand and to get involved. Farmers would be compensated for practices they have been using for generations, hence, requirements should be easy to understand and the decision making process transparent. In many PES schemes potential sellers are confronted with market focus on abstract services or are expected to understand complex rewarding systems based on complicated proxies. In the case of *Montado*, most of farmers would not have to substantially change their productive system in order to sign up for the program.

The English Environmental Stewardship Scheme (ESS), discussed in Chapter 5, was developed to target environmental problems similar to those currently faced by *Montados* (*i.e.* threat of land use change, which may decrease provision of ES by agricultural

landscapes). Thus, its primary objectives also correspond to conservation actions needed for this ecosystem: biodiversity protection and maintenance of landscape quality and traditional character. Although improvements can still be made, the ESS positive environmental outcomes are undoubted. Using the ESS framework as a start point for implementing a similar scheme in *Montados* may be a wise option, especially because it builds on UK's 25 years of experience on AES, and on the notable achievements of previous environmental programs in England. Evidently, there are several differences between the Portuguese and the British context that are likely to influence the application of AES. Following, particular issues that must be carefully addressed when tailoring Stewardship Payments to *Montados* are discussed.

Funding

The ESS is part of the Rural Development Programme for England (RDPE), which is funded by the national government and EU. Portugal also has a Rural Development Program (PRODER – *Programa de Desenvolvimento Rural*) partially funded by the EU, and created in the context of the European Commission Rural Development Policy 2007-2013⁸. However, while the English program allocates 80% of its budget to environmental measures, Portugal's PRODER places stronger emphasis on competitiveness, selectivity and on chain approach. Only 40% of the PRODER budget is transferred to the one axis concerning environmental measures (*i.e.* axis 2 – *Sustainable Management of Rural Areas*). In fact, England's program not only has superior budget and allocates a greater share of it to environmental measures, but also is less dependent on EU funding.

⁸ Information about all Rural Development Programs under the European Commission Rural Development Policy 2007- 2013 is available at: http://ec.europa.eu/agriculture/rurdev/index_en.htm

As a conclusion, government-funded Stewardship Payments in the modes of the ESS are likely to face funding limitations in Portugal, as in this country AES are not a national priority as they are in England.

The Intermediary

Most PES programs rely on a strong intermediary who acts as the cornerstone of the scheme. Although several intermediaries may be involved at different stages, it is important that there is a stable focal point to push the complete process: from design and implementation, to operation and continuous adaptation. It has to be a strong, trustworthy and enduring institution (FAO, 2010a). The ESS relies on the Natural England as a centre intermediary, which is a public body fully dedicated to protect and improve England's natural environment. One crucial point for implementing AES in *Montados* is to involve a strong intermediary to undertake roles such as dealing with contracts, making payments, monitoring compliance and offering farmers technical advice and support.

Understanding the Science

The point system used by ESS to estimate payments is based on substantial understanding of how each management practice contributes to the desired environmental outcomes. Effort-based payments must rely on correct establishment of the link between management practices and ES outcomes, otherwise the desired environmental results will not materialize. Thus, intensive research is necessary to document *Montado* management practices, and to assess their contribution to biodiversity protection. In addition, contracts must be elaborated in order to require management practices to meet minimum standards of

ES delivery.

Targeting

As funding may limit the program dimension, the number of applicants is likely to exceed the number of contracts that can be supported. If this is really the case, targeting can be used to increase additionality. The best strategy is to implement contracts in areas where threats of land use change are higher and payments can make a greater difference.

Establishing payments

Payment must be attractive enough to convince farmers to join the programme. Therefore, they have to cover the opportunity cost and any type of investment required. Ideally schemes should offer differentiated levels of payments (variable fee), corresponding to the variation of participation costs among farmers. In practice this adjustment is very costly, and many AES implement a flat fee (*i.e.* fixed payment) based on the average opportunity cost (FAO, 2010a). Flat fees are easier and cheaper to administrate, as well as easier for landowners to understand. The problem of using fixed payments is that landholders with opportunity costs higher than the average will not be attracted to the program, while those with lower than average costs will be overpaid. Another disadvantage is that it can lead to service provision over or under societal desired levels, as discussed in section 5.3.2.

Variable fees are more cost-effective, as landholders are paid exactly for what they need to participate. They can also be more effective in delivering ES if based on right science. However, this type of payment is more complicated to design and implement. Visiting each landowner can be costly and systems used to make payments competitive (*e.g.* tender or auctions) are not very transparent to farmers.

Payments for *Montado* farmers could follow the model applied by the ESS, which uses both types of fees by creating different levels of enrolment (*i.e.* Entry and Higher Level Stewardship). This is a wise strategy, because while the Entry Level, based on fixed fees, guarantee the enrolment of a high number of farmers and promote conservation at landscape level, the Higher level, based on variable payments, targets priority areas such as habitats of endangered species, watersheds or historical sites.

What has already been done in this context?

A relevant initiative in the context of government-funded measures for *biodiversity protection* in *Montados* are the Territorial Integrated Interventions (ITIs). ITIs are a set of measures created by the PRODER in order to promote agriculture and forest management compatible with biodiversity and landscape conservation. In general, these measures intend to support the continuity and recuperation of systems threatened by land use change through financial compensation for conservation or safeguarding of landscapes. Each ITI is tailored to the site concerned according to its particular characteristics (PRODER 2011a). Several *Montado* sites are included in the ITI concerning “Natura Sites in the Alentejo Region” (Intervenção Territorial Integrada Zona Rede Natura do Alentejo), which was created very recently, in January 2011.

Payments are made for specified management practices related to agricultural production (*e.g.* permanent extensive management of pastures; restricting grazing and protecting vegetation patches), forestry (*e.g.* maintenance of riparian galleries; maintaining and enhancing habitats for Iberian Lynx and eagles; Renewing *Quercus sp.* population), or for other activities to protect biodiversity (*e.g.* combating alien species; enhancing habitat for wild fauna; restoring riparian vegetation) (PRODER, 2011b). Payments range from € 10-

100 ha⁻¹ for each management practice, depending on the area size, and contracts last for five years. To enroll the program, farmers have to develop a management plan, as well as to meet general commitments regarding good environmental stewardship (*e.g.* protect riparian vegetation; avoid fires), but they are not required to select a minimum number of practices. Details about the application process, monitoring and compliance enforcement were not found.

Applying AES to Montados: Conclusion

The main challenges in applying AES to *Montados* are limited funding and the need for a strong and competent institution to work as cornerstone. However, the implementation of ITT corroborates the evidences that AES might be suitable for these landscapes. Although small in size and scope and restricted to Natura2000 sites, this initiative represents a first step in implementing *payments for environmental stewardship* as a conservation tool for *Montados*. If correctly managed, AES can evolve over time, which includes not only growing in size, but also to improving targeting, increasing additionality and, consequently, improving environmental outcomes. Lessons learned from programmes at more advanced stages can substantially contribute at the design stage, as well as to make adaptations in already running programmes.

6.3 Payments for Carbon Offsets (Forest Carbon Project)

Carbon projects work by producing GHG emission reductions, which are then certified and traded in the several existent carbon markets. The idea is to claim payments for climate regulation services that landholders provide to society by undertaking management practices that increase, or maintain, the levels of carbons stock. As reviewed in Chapter 2, *Montados* play important role in carbon sequestration and storage and represent a large

share of the Portuguese carbon stocks. For this reason, several authors believe that carbon projects are a promising conservation tool for this ecosystem (Branco et al., 2010; Bugalho et al., 2011).

In practice, however, entering carbon markets is not easy. In order to be tradable, carbon offsets generated by a project have to be certified by meeting one of the several existing carbon standards (*e.g.* The Verified Carbon Standard, The Clean Development Mechanism, The Climate, Community & Biodiversity). Standards usually have very strict criteria, which many times make carbon projects inaccessible or prohibitively expensive.

In addition, the fact that *Montados* are important carbon sinks does not necessarily qualifies this ecosystem for entering carbon markets. Carbon offsets are based on additionality, thus, carbon sinks should only receive payments if they are under severe threat and are not likely to last in the absence of conservation efforts (degrading baseline). Even when this is the case, very few schemes are exclusively based on offsets from avoided degradation. Most of them focus on increasing ecosystem capacity of carbon sequestration and storage, or at least combine it with avoided degradation.

Another barrier for the implementation of *Montado* carbon projects is that efforts for increasing carbon sequestration and storage could threat this system ecological stability. This is because its conservation value relies on the mosaic formed by different elements and land uses, which support high biodiversity. Enhancing specific components to increase carbon gains (*e.g.* increasing tree cover) could decrease landscape heterogeneity and jeopardise provision of ES other than climate regulation. For this reason, a payment scheme for *Montado* climate regulation services should follow an approach similar to the Scolel Te Project, in Mexico, analysed in Chapter 5. The standard adopted in this project, the Plan

Vivo standard, requires farmers to develop management plans that combine activities to generate carbon benefits with good environmental stewardship and the provision of other ES, such as biodiversity preservation, soil fertility and water quality.

Following, the main challenges of implementing a carbon project in *Montados* are discussed, based on lessons learned from the Mexican experience and on the guidelines for *Building Forest Carbon Projects* elaborated by Olander & Ebeling (2011).

Project Activities and side objectives

The first step to implement a carbon project is to establish what type of activities will be undertaken to generate carbon benefits. The activities implemented have to be consistent with any other environmental and social co-benefits the project is trying to generate. For instance, the Scolel Te project promotes reforestation, forest protection, and agroforestry that, besides increasing carbon gains, improve crop productivity, soil quality and protect watersheds. When defining key interventions to enhance carbon sequestration and storage in *Montados*, project developers must pay special attention in maintaining productive and heterogenic landscapes.

Scientific and Technical support

There are some fundamental issues that must be addressed during the conceptualization of a project that requires intensive scientific and technical support. The first of them is the estimation of *Montado* carbon stocks and/or sequestration potential. Although some preliminary estimation have already been done, they would have to be reviewed and adapted to specific characteristics of the project's site in order to build reliability among verifiers and buyers. Following, it is necessary to characterize a baseline taking into

account the actors involved and the driving forces of land use change. The baseline is used to estimate the carbon benefits that the program is expect to generate. Then, possible impacts on local populations, ecosystem services and biodiversity have to be assessed. In addition, substantial understanding of the impacts of each management practice on *Montado* carbon potential would be required in order to develop guidelines for management plans. It is important that such plans are concise with environmental and social standards set by the program.

In view of the substantial support required, small-scale projects are usually only feasible with cooperation of institutions that can provide technical and scientific advice at minimum costs, such as NGOs and research centers. However, as carbon markets expand, more and more tools and resources to help project developers with the most diverse tasks are made available for free⁹.

Carbon standards

Carbon offsets from *Montado* projects are not likely to meet the criteria of the Kyoto Protocol and EU ETS standards, and, for this reason, they cannot be traded in regulatory markets. Nevertheless, there are several alternative standards, which are usually less strict and consider offsets from a wider range of land use options. Standards usually classify projects according to the activities they promote. Although projects can combine more than one type of activity, focusing on a single type can simplify the certification process. Three types of projects relevant for *Montados* that are usually considered by voluntary standards are:

⁹ For carbon assessment see: IPCC (2003); EFI (2009); USAID (2011)
For additionality assessment see: UNFCCC (2007); VCS (2010);
For general guidance on developing a project idea see: BioCarbon Fund (2007)

- Afforestation and Reforestation (AR) Projects; referring to planting trees or converting non-forested area to forested land.
- Reduced Emissions from Deforestation and Degradation (REDD) Projects; REDD which aim to avoid the conversion of forests to non-forested areas (deforestation) or to avoid activities that reduce their carbon stocks (degradation).
- Improved Forest Management (IFM) Projects, which are projects seeking to actively improve forest management to maintain and/or increase carbon stocks in forest areas or remaining forests.

In fact, most of standards focus on forest ecosystems and, although *Montados* have a significant forest component, they are still agro-sylvo-pastoral systems. It is very likely that complying with these standards would be either impossible or require a significant change towards forest systems. In this regard, the approach used by the Scolel Te Project was to create a brand-new standard, the Plan Vivo, to fit the objectives of project developers: implementing community-based PES schemes. Ideally, the same approach should be used for *Montados*, where the new standard would be consistent with their socio-environmental context, and the activities promoted would focus on maintaining oak trees as carbon sinks without jeopardize landscape heterogeneity. In practice, creating a new standard and building reliability is a very complex task and only possible with strong financial and technical support. The Plan Vivo was created in the context of a research project carried out by a solid partnership responsible for providing all funding and technical support for this to happen. The group included strong research centres, NGOs, government bodies, among other institutions. Creating a carbon standard for *Montados* would require an initiative in similar proportions.

Project size vs. cost

There is no fixed minimum size for carbon projects, but very small programs may find transaction costs prohibitive. These costs refer to hundreds of thousands of dollars spent with validation, monitoring, verification, and market engagement. Moreover, market intermediaries and investors usually do not look for projects offering less than 10 000-20 000 t CO₂ emissions reductions per year. Considering *Montado* carbon sequestration rate estimated by Pereira et al. (2007) of 5,13 t CO₂ ha⁻¹ yr⁻¹, a project within this ecosystem would have to comprise at least 2 000 – 4 000 hectares.

Funding and buyers

Revenues from carbon sales take some time to materialize, as offsets have to be verified and issued. As project design and technical development require significant resources, project developers have to rely on other types of investments, at least during the early stages of the program. Possible sources of investments are described below. Note that different types of investors can play important roles at different stages.

- Donor support: Private donors may be willing to provide funding for some fundamental activities. It is common that this type of investor value social or environmental co-benefits besides climate regulation services.
- Forward finance from buyers, investors, or commercial project developers. These are investors who may be willing to provide upfront finance in exchange for rights to future carbon credits or revenues.
- Self-financed investments. When project developers are or include well-resourced organizations, they can use their own financial resources to cover the main costs of the

program.

The Scolel Te shows that small-scale projects outside the regulatory markets can evolve to operate in an entirely self-sufficient basis. Fortunately, there are several resources available online to help project developers with commercialization and finance of carbon projects, such as business guides (see Chenost et al., 2010; Covell, 2011) and analysis of carbon markets (see Neef et al., 2010; Peters-Stanley et al., 2011).

What has already been done in this context?

In view of the important role Oak trees plays in climate regulation, many authors suggest implementation of payments for carbon sequestration and storage as a promising conservation tool for *Montados* (Branco et al., 2010; Bugalho et al., 2011). However, no evidences of projects implemented in this ecosystem were found. Actually, carbon projects are absent within the whole Mediterranean basin, and the number of projects in Europe is very low (Forest Carbon Portal, 2011).

Conclusion

The number of projects implemented worldwide focusing on forest systems has been increasing, and so has the volume of forest carbon credits traded on voluntary markets. In view of the popularity of payments for carbon offsets, many people see this type of project as an ultimate solution for environmental problems involving forest systems. In practice, however, developing a carbon projects is extremely complex. It requires a great deal of scientific work to estimate carbon potential and benefits, plus complying with rigorous standards, working through a variety of legal, business, community and environmental-related issues, and actually carrying out the challenging work of undertaking land

management activities that go beyond business as usual in order to generate carbon benefits (Olander & Ebeling, 2011). More challenges may emerge when projects are small in scale and when the target ecosystem does not fit the requirements of existent carbon standards.

For the aforementioned reasons, projects developers may not be able to bear the costs and complexity of implementing a carbon project in *Montados*. Even if these landscapes are important carbon sinks, and despite all the guidance material available, a carbon project is not likely to be feasible unless within an unique situation, where strong institutions join forces and provide all the technical, scientific and financial support, as it happened in Mexico. Not surprisingly, there are no records of carbon projects implemented in *Montados* so far.

Chapter 7

Conclusions

Natural systems provide a multitude of goods and services that benefit human societies directly or indirectly. With few exceptions, most of these ES are currently undervalued or have no economic value at all. As a result, ecosystem managers have no direct incentives to ensure their provision, even if they are vital to human well-being. The market failure in incorporating the value of natural systems is a major reason behind ecosystem losses and unsustainable resource exploitations currently observed worldwide.

PES is considered a new promising approach for conserving the natural capital that provides ES and, consequently, supports human well-being. This mechanism is expected to be more efficient than traditional approaches because it accepts the existence of hard trade-offs and tries to realign conflicting interests. Furthermore, it is attractive to policymakers because, among other reasons, it represents a new source of income for conservation actions, and can work for economic development while promoting environmental conservation.

Despite the growing enthusiasm for PES, there are several caveats that must be taken into account to determine whether PES is a viable policy tool to address a certain environmental problem and, if yes, which of the several types of schemes represents the best approach. Different types of deals falling under the definition of PES can be effective and cost effective in different situations. In any case, schemes have to be tailored to specific socioeconomic, political and environmental context. As a result, the application of this instrument is complex, many times costly, and requires strong scientific basis. Therefore, PES is a conservation tool with several advantages, but its application must be restricted to situations where it can potentially achieve desired results.

The present work analyzed the potential of PES as a conservation tool for a threatened

ecosystem in Portugal, the *Montado*. First, the potential of ES provision was assessed, as well as the current demand for them. The conclusion drawn was that *Montado biodiversity protection* and *carbon sequestration and storage* services could potentially be included in PES programs. This insight was complemented with lessons learned from the analysis of three case studies. Cases were selected in order to constitute a representative set of PES mechanisms compatible with *Montado* market limitations and particular characteristics. Although there are several PES implemented around the globe, discussions about the conditions underpinning their success/failure are still limited in literature. Thus, another issue taken into account in the selection process was information availability.

A few important conclusions can be drawn from the analysis described above. The first important contribution of this work is to highlight that implementing PES to *Montados* – or to any other ecosystem - requires more than provision of important ES. Several authors propose PES as a conservation tool in view of the relevant ES *Montado* provides. However, assessing the demand side is as important as looking at the supply side. This work shows that there are several market limitations for *Montado* services, and there is no point in designing payments for ES if no one is willing to pay for it. Besides, other fundamental challenges that were common to the three case studies analysed and can be a barrier to PES in *Montados* are: i) finding reliable sources of funding; ii) the need for a strong intermediary to serve as cornerstone of the scheme; and iii) understanding the science behind ES provision and the influence of management practices.

Despite the challenges and complexities described above, this study also showed that PES can achieve significant environmental outcomes, even if programs have limitations or are not operating as expected. In fact, the case studies analysed are only a few examples among

numerous PES implemented worldwide that have achieved successful conservation outcomes. This is still a relatively new policy tool, and its increasing popularity among conservationists and policymakers is expected to motivate improvements. Furthermore, although there is no universal framework for the application of PES, much can be learned from looking at previous experiences with this instrument. In this regard, lessons learned can serve both as a starting point for policy design, as well as to make adaptations in already running schemes.

Another important conclusion is that none of the mechanisms analysed should be considered a universal solution for *Montado* environmental problems. The present work, for the sake of simplicity, looked at *Montados* as a whole, but in fact these landscapes comprises 1 125 000 ha in Portugal, which may include local variations in ecosystem characteristics, provision of ES, as well as in socio-economic and political context. Local particularities may influence the effectiveness of PES, hence, it is likely that different mechanisms will be effective in distinct *Montado* sites. In addition, PES schemes can be effective at different levels. For instance, while government-funded deals (*e.g.* AES) can be efficient to promote conservation at the landscape level and to enhance provision of ES that are public goods, small-scale user-financed schemes (*e.g.* Environmental certification) are more effective to solve local problems.

For the reasons mentioned above, the implementation of not one, but several instruments, is more likely to work for *Montado* environmental problems. These instruments do not necessarily have to be the ones analysed in this document. There are several other economic tools that, when properly designed and used in appropriate circumstances, can work for environmental conservation. Moreover, the efficiency of economic instruments

can be enhanced when they appear combined with other types of policy tools. Compliance markets emerging from the creation of environmental regulations can be an important source of demand for certain ES. More strict policies requiring compensation of impacts on ecosystems and biodiversity are expected to emerge in a near future, both at EU and national level. Also, regulatory carbon markets are lowering their legal barriers to include carbon offsets from a broader range of projects, such as those targeting agro-forest systems.

Future developments

The need for future developments was highlighted several times along this document. In regards to PES, there is a strong need for scientific research underlying the link of ES provision and land use systems. Most of PES schemes still effort-based, which in part complicates their assessment and limits efficiency. Similarly, understanding the trade-offs among the different ES provided within ecosystems is a crucial step for using PES as a conservation tool. Moreover, research on people's willingness to pay for nature's services can substantially contribute to estimate appropriate values and help to improve PES results. In general, publications substantially assessing PES schemes are scarce, and even scarcer are studies about the underlying causes of success/failure of PES deals.

In respect to environmental policy solutions for *Montados*, necessary researches can be divided in two groups. First, a wide range of basic information is needed for designing instruments – PES or not – such as: the scientific basis of ES provision; the drivers of land use changes in the region; and the expected future scenarios and predicted changes in ES provision. Additionally, more detailed research is needed about *Montados* socioeconomic, political and ecological contexts, and their influence on the efficiency of economic instruments. In this regard, both a general look at national level and site-specific

investigation could bring useful information to help PES implementation. Second, similar researches to the present work, but focusing on other types of conservation tools, are highly necessary in order to design an optimal policy combination for conserving the *Montado* ecosystem.

Chapter 8

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APPENDIX - Endemic and Endangered species found in Montados

Table I. Endemic Species to the Iberian Peninsula found in *Montados* (after Branco et al., 2010)

Scientific Name	Popular Name	Scientific Name	Popular Name
<i>Alytes cisternasii</i>	Iberian Midwife Toad	<i>Triturus boscai</i>	Bosca's Newt Iberian
<i>Chalcides bedriagai</i>	Bedriaga's Skink	<i>Anaocypris hispanica</i>	Jarabugo Fish
<i>Discoglossus galganoi</i>	Iberian Painted Frog	<i>Luciobarbus comizo</i>	Iberian Barbel
<i>Lacerta schreiberi</i>	Schreiber's Green Lizard	<i>Chondrostoma willkommii</i>	Guadiana's Bogue
<i>Podarcis carbonelli</i>	Carbonell's Wall Lizard	<i>Microtus cabreræ</i>	Cabrera's Vole
<i>Rana iberica</i>	Iberian Frog	<i>Lynx pardinus</i>	Iberian Lynx

Table II. Threatened and Endangered Species found in *Montados* (after Branco et al., 2010)

Species	Popular Name	Conservation status
<i>Anas clypeata</i>	Northern Shoveler	¹ EN (⁴ Res)
<i>Aquila chrysaetus</i>	Golden Eagle	¹ EN (⁴ Res)
<i>Ardea purpurea</i>	Purple Heron	¹ EN (⁶ MigRep)
<i>Ardeola ralloides</i>	Squacco Heron	² CR (⁶ MigRep) and ¹ EN (⁵ Vis)
<i>Chlidonias hybrida</i>	Whiskered Tern	² CR (⁶ MigRep)
<i>Circus pygargus</i>	Montagu's Harrier	¹ EN (⁶ MigRep)
<i>Coracias garrulous</i>	European Roller	² CR (⁶ MigRep)
<i>Hieraetus fasciatus</i>	Bonelli's Eagle	¹ EN
<i>Milvus milvus</i>	Red Kite	² CR (⁴ Res) and ³ VU (⁵ Vis)
<i>Neophron percnopterus</i>	Egyptian Vulture	¹ EN (⁶ MigRep)
<i>Netta rufina</i>	Red-crested Pochard	¹ EN (⁴ Res)
<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	¹ EN (⁶ MigRep)
<i>Otis tarda</i>	Great Bustard	¹ EN (⁴ Res)
<i>Pterocles orientalis</i>	Black-bellied Sand grouse	¹ EN (⁴ Res)
<i>Pyrhacorax pyrrhacorax</i>	Red-billed Chough	¹ EN (⁴ Res)
<i>Tringa tetanus</i>	Common Redshank	² CR (⁷ Rep)

¹Endangered; ²Critically Endangered; ³Vulnerable; ⁴Resident; ⁵Visitor; ⁶Migratory Breeder; ⁷Breeder.